THE

ELECTRICAL REVIEW.

VOL. LIII. DECEMBER 4, 1903. No. 1,358.

"ELECTRICAL REVIEW."

Vol. LIII.] CONTENTS: December 4, 1903. [No. 1,358.

	Page
The Safety of Tube Railways	889
Gas-Pipe v. Copper: A Defence	891
Electrical Promotions—Session 1904	892
Correspondence	894
Obituary	900
Legal	901
Business Notes	901
Blast Furnace Gas Power Plant at Ilseder Iron Works (Germany) (*illus.*)	907
The Greenhill Electricity Works, Oldham Corporation (*illus.*) (*concluded*)	908
Devices and Fittings for the Current Electric Lighting Season (*illus.*) (*concluded*)	911
Electricity Supply Accounts	917
City Notes	917
Stocks and Shares	918
Share List of Electrical Companies	919
Market Quotations	920
Electric Tramway and Railway Traffic Receipts	920
Metal Market.—Fluctuations in November	921
Institution of Electrical Engineers:—	
The Edison Accumulator for Automobiles (*concluded*)	921
Inaugural Address by Mr. E. W. Cowan (Manchester)	924
Inaugural Address by Mr. W. A. Chamen (Glasgow)	924
Discussion on Mr. Schofield's paper (Leeds)	925
Speed Variation of Continuous Current Motors by Shunt Control (*illus.*)	926
Our Legal Query Column	928
New Patents Applied For	928
Published Specifications	928

THE

UNIVERSAL ELECTRICAL DIRECTORY

1903 Edition

Price 10s. Post Free.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGREKAY, LONDON." Code, A B C.

Telephone No. 983 Holborn.

All Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, AND HAS

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—In Great Britain, Post Free per Year, 19s. 6d. To all other countries, per Year, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can now be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street, Paris: VEUVE J. BOYVEAU, 22, Rue de la Banque. Berlin: ASHER & Co., 13, Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE SAFETY OF TUBE RAILWAYS.

THE letter which we publish on another page, relating to the condition of the glow lamp fittings on the City and South London Railway, raises a question of great importance both to the public, as passengers, and to the shareholders. Our correspondent alleges that he found "the fittings" in a car alive, and that the attendant declared that he was in the habit of receiving shocks in almost all the cars, sufficient to throw him on the floor! If this statement were true, it would constitute a scandalous condition of affairs; happily, however, it is wholly unfounded, as we shall show.

Apart from actual investigation, ordinary common sense should suffice to demonstrate the utter impossibility of such a condition subsisting. Obviously, if passengers were constantly liable to receive shocks, they *would* receive them, and an outcry would be raised at once. Further, if the attendant were "in the habit of receiving shocks in 'almost all the cars,' sufficient to throw him on the floor," he *would* be thrown down, and the astonished passengers would not forget to give the occurrence the widest publicity! We have seen what one or two of our ha'penny dreadfuls can do in the way of promoting a scare, and they would not miss such an opportunity. Clearly, therefore, such a state of things could not exist for a day without entailing an unenviable notoriety.

Nevertheless, to make assurance doubly sure, two of our staff, including one of the editors, have made a personal investigation into the matter. For this purpose Mr. P. V. MacMahon, the chief engineer to the company, kindly afforded facilities for us to test the fittings and to question the railway staff. So far as we could ascertain, the number of complaints of shocks received by passengers, during the 13 years this pioneer and all-British railway has been running, has not exceeded two, and neither of these occasioned more than momentary discomfort. During the whole period of its existence, not a single fatal accident has occurred on this railway—truly a splendid record, seeing that it has carried upwards of 130 million passengers to date. To return to the fittings—we personally tested over 400 of these, going through train after train at random as they arrived in the Clapham terminus. In only two cases was there any evidence of leakage whatever; in one of these, the slight tingling was perceptible to only one of us; in the other, in the case of a lamp at the beginning of a series of five, which, therefore, was at a potential of 400 or 500 volts above earth, the leakage was so slight that we were able to maintain hand contact with the fitting without the slightest discomfort, for any length of time. The fact that the floor is of dry wood, no doubt explains the mildness of the sensation; it also renders it impossible for us to believe that anyone could be knocked down by a shock received in this way. Nor did we see any possibility of a passenger

accidentally touching a fitting simultaneously with any earthed metal. In fact, the whole question appears to be based upon a mere *canard*, and were it not for the risk that a mistaken impression might get abroad, we should not think it worth while to devote our time and space to its discussion.

We may add that the cars are constantly under inspection, and the staff in charge of the train lighting is continually at work cleaning, examining and renewing lamps, and maintaining the apparatus in perfect order. Whenever by chance a fitting develops a leak—which has been known to occur, for example, through a faulty lamp-collar—the defect is at once detected.

Our inspection proves that the wiring is not faulty: as for the question of the safety of passengers, so much has already been written on this subject in the technical Press that we need not dwell upon it. Even if the long record of the City and South London Railway were not sufficient to prove its safety, ample additional safeguards have been provided, and the most timid passenger need have no fear in travelling upon it.

Our correspondent says he does not want to alarm the public, but we fear that his letter, unaccompanied by an authoritative statement of the facts, would have produced precisely that effect, most undesirable in the public interests when it is not justified.

Our South African Market.

LAST week we published a brief account of the report just drawn up upon the trade of South Africa by Mr. Henry Birchenough. British South Africa is already one of our chief over-sea markets; possibly, not so far hence, it may take precedence over India, and become of primary importance to British manufacturers. It is not surprising, therefore, that this report should have been awaited with considerable impatience, and that it should be studied with minute attention. Mr. Birchenough holds that the prosperity of South Africa is to grow in the future; that the industries there are sound, and not speculative like the market in many of its securities. He says the bulk of the trade is in our hands, but that the United States, in certain circumscribed directions, and Germany, over a wider range of commerce, are formidable competitors, with Belgium and Switzerland in the second rank. But, having said so much in fairly optimistic vein, Mr. Birchenough becomes a trifle pessimistic, and, generalising on somewhat well-worn lines, appears to condemn our manufacturers *en bloc* for their faulty methods, which, if pursued, may leave to other nations the bulk and best of the orders soon to be given out. In fact, Mr. Birchenough seems, at first sight, to have assumed in this matter an unscientific attitude improper for a Government official, and more characteristic of a reporter belonging to the panic-stricken halfpenny press.

Mr. Birchenough has written as if the shortsightedness, carelessness, and occasional stupidity shown by some of our manufacturing firms—faults which cannot be denied—were common to all; and therefore we have said that he appears to have become unscientific, illogical, and conceivably superficial in his arraignment of British methods. It is necessary to remember that, at least in those departments of trade with which we are concerned, Mr. Birchenough is not the only expert who has made a local study of South African commercial phenomena. Our contemporaries, the *Engineer* and the *Ironmonger*, have both sent out specially-trained representatives, and their reports have been published some time. We find in them, in the latter at all events, a measured condemnation of some British methods—the same methods which Mr. Birchenough holds up to ridicule—but we do not see the wholesale condemnation there which is uttered by the Board of Trade Commissioner.

But is Mr. Birchenough actually so unscientific in the line he has taken when the whole circumstances of the case are kept evenly in mind? Is it not possible for him to show justification? Every class of mankind is judged, unfairly maybe, but inevitably, by the action of its most conspicuous members; and such is human nature that the most conspicuous members of a class are those who are most notorious, *i.e.*, those who draw attention to themselves by doing absurd, wrong-headed, or illegal things. Most owners of motor-cars, probably, are law-abiding citizens; but we can hardly help ignoring them and thinking only of the minority who appear in our police courts. Similarly, an up-country buyer in some distant Colony places an order with a certain firm at home, and finds the goods to arrive late, broken, not to specification, so packed as not to bring the cost of carriage to a minimum, or something else equally annoying. He can hardly avoid jumping to the conclusion that all other firms in the country will prove as troublesome, for he is not likely to be less hasty, bad-tempered, and indignant than the rest of us. If, on the other hand, his order goes through smoothly and satisfactorily, he receives a pleasant impression; but the point to be remembered is that pleasant impressions are evanescent, unpleasant ones permanent.

We at home whose tempers and pockets have not been touched by an episode of this kind, and who, very possibly unlike the Colonial customer, know that the firm in question is not one of our best or even average manufacturing concerns; we, and the more enlightened companies of the same trade, wax righteously wroth with that colonial customer for generalising on such wickedly insufficient data, and we are scarcely less angry with Mr. Birchenough for reflecting his views. But if we examine our own hearts, we shall find we do the same thing every day of our lives. We smile at the emptiness of the schoolgirl's threat, "I'll never speak to you again," but very frequently we of the sterner sex, men of supposed common-sense and men of affairs, carry out that threat in a way the girl would scorn to do.

The fact of the matter is, that just as a creed is judged by its devotees, so a trade is judged by its exponents; and the devotees or exponents who bulk most largely in our minds are the bad ones. It is a great pity, it is most unscientific and illogical, it is even wrong; but it is inherent to mankind. If, therefore, Mr. Birchenough stands convicted before his fellow British subjects of having represented the worst as the average, his is but an intellectual sin; he has drawn a picture out of all perspective, but the false laws which distort his picture are the same false laws that disfigure the pictures on exhibition in so many of our foreign markets. Indeed, it may be argued very forcibly that those laws are true rather than false—in a word, that the foreign, if not home, reputation of a trade is actually that of its least reputable representatives. We do not say it should be—we should like to say it should not—we say it is.

There are, of course, other matters in Mr. Birchenough's report at which no one can cavil, unless he objects that the accusations are not brought with sufficient insistence. In Great Britain we are constantly grumbling at the heavy charges and burdensome regulations imposed on trade by our great railways. Now, we are not the chief nation in the world from the railway aspect when mileage is considered, and therefore it may not be altogether surprising if in some respects inland goods carriage is managed better elsewhere. But we are, and for centuries have been, the chief over-sea carriers and the owners of the largest and most experienced mercantile marine; so that it reads like a grim joke to find that British trade with a British colony is handicapped by the action of a British shipping trust. We own 11,000 out of under 30,000 ships afloat in the world, our tonnage is 15 millions out of 32 millions; the figures for the United States are roughly 3,000 and 2¼ millions—and it costs twice as much to send a ton of merchandise to the Cape from Southampton as it does from New York.

The subject is an unpleasant one to mention, but it is true that the British manufacturer has some excuse for not rushing with open arms to meet the oversea buyer. In this

matter we have had perhaps greater, certainly longer, experience than the United States and Germany. It has happened in the past when goods have been sent abroad, not only to ports flying a foreign flag, but to places under the rule of the British Crown, that there have been little difficulties in the subsequent transactions. Weights at the port of entry have been different from those taken at home, and the difference has usually been in one direction; deliveries have been stated or sworn to be different from sample or specification, and to save ruinous lawsuits the goods have been sold by auction to a local buyer fully alive to all the circumstances, and at a corresponding price. We do not say these things have happened, or are likely to happen, in South Africa; but the manufacturer whose education leads him to class all places outside the British Isles as "foreign parts," and who has not made a study of politics and ethnological or national morality, may be expected to fight shy of expending the time and money in orders for a market over which he has little personal supervision.

Fatal Accident at East London (Cape Colony).

Serious electrical accidents to members of the public in their own homes are almost unknown. We cannot recall a single case in this country. Following close on a fatal accident of this kind which occurred recently in Germany, an account came to hand by last mail of the death of a young man at East London (Cape Colony) owing to a leak from a trolley wire. The deceased was in a bath, and the electrical conditions of low resistance which contributed to the fatal accident at Fulham must be held accountable for the result in this case. The report of Mr. J. Denham, the Government electrician, which is very detailed and of great interest, gives nine conditions which he says must have been present simultaneously, and the lack of any one of them would have rendered the original breakdown practically innocuous. The trolley wire appears to have been provided with single instead of double insulation, the span wires were probably not provided with ball insulators, and on the failure of the trolley wire insulator, the poles became alive. The poles nearest the house in which the fatality occurred carried an arc lighting circuit, and a 110-volt alternating current lighting circuit, as well as the span wires, but these lighting circuits were in good order. To discover the cause of the accident required a good deal of investigation, and this, fortunately, was ably conducted by Mr. Denham. His tests, which are in themselves of considerable interest, proved that the current was led into the house and up to the bath by the iron pipe in which the service wires of the electric supply were brought in. This happened to touch the bath waste pipe, and the water supply pipe made the earth connection. The chance of such a condition occurring is, as Mr. Denham says, remote, and the remedy which is threatened, namely, the bonding of each tramway pole to the rails, is a heavy price to pay as a preventative. The bonding of the poles together by an overhead wire, like a guard wire, and the bonding of 1 pole in 10 to the rails, would serve to open the circuit breaker, and that is all that is required.

The chief feature of Mr. Denham's report is his account of the tests of fall of potential in the soil. Leaks from underground cables in this country have occasionally given rise to shocks to pedestrians, and in more than one case a horse has been killed. The reason why the effects have not been more serious is, that (although the electrical pressure has in some cases been high) the victims have not straddled over enough ground to bridge a large enough fall of potential. The conductivity of the soil, of which very little is known, plays an important part in this question; it must have been very small in this case, or, in other words, its resistance must have been so high that the iron service pipe was practically insulated. With a moist soil, the potential gradient would have been less, and with it, the chance of shock from the earth.

GAS-PIPE v. COPPER A DEFENCE.

By C. Alfred Smith, B.Sc., A.I.E.E.

To have drawn a reply to the article "Gas-Pipe *v.* Copper" from so prominent a writer as Mr. E. Kilburn Scott, is at least satisfactory. Unfortunately Mr. Scott is convinced at the outset that power transmission by gas need not be seriously considered as a rival to electric power transmission—even assuming that overhead wires are impracticable and coal is cheap. In his reply he considers that all his electrical friends think with him, and that there remains, therefore, little to do but to amuse himself and his readers by a spicy and good-humoured dismissal of his opponents. His reply is a delightful piece of light reading which must have cheered, and even scandalised, the subscribers to so staid a journal as the Electrical Review, in their weekly search for knowledge and enlightenment.

It was hoped that the suggestions advanced would bring forth effective criticism, and be the means of obtaining more reliable data to work upon. It has at present failed to do this. It has only succeeded in drawing from its scabbard the rather blunt sword of a controversialist, who at one moment holds his weapon in a threatening attitude, and when the crushing blow is expected, reasuress us with his comic remarks, as though he would fain have us believe that his bright sword is only of wood, with a coating to make it look like steel. It reminds one of the old-time king's jester who says: "I have here a wooden sword; I have at home a steel weapon which I will use on occasion." And it is somewhat sad to recognise a warrior so renowned in the cause of electrical progress using the wooden sword. It is only because I believe that Mr. Scott could throw some useful light upon the subject, if he cared to do so, that I venture to write this defence. If it will provoke him to handle the question in a manner worthy of his reputation, if it will draw from him convincing figures and actual proofs that the thing is impossible, it may yet save some thousands of pounds which have been invested in, not one, but several, schemes of gas transmission. If he can add one iota of evidence which would show that the cheapest method of producing electricity is settled for ever, he will help forward the industry which he, in common with everyone concerned in it, believes to be the most progressive.

The most amazing sentence in the reply is the proud boast that "all electrical measurements are absolute and right down on the nail"—amazing, not because anyone would doubt the veracity of the statement, but because it should be used in an article in which *not one single absolute measurement is quoted*, not one fraction of numerical evidence advanced, to support a cleverly concocted series of empty phrases; nor is one single new figure bearing upon the subject mentioned. From anyone less respected than Mr. Scott it would almost amount to impudence; in his case it must be attributed to his "hurry-skurry" methods and his desire to pose as a humorist.

In order to treat the points raised by this amusing critic in order, let me first assure him that the object of the article was not to retard electrical progress, but an honest attempt to help it forward. Substituting gas pipes for copper does not mean that such an excellent lighting and power agent as electricity would be retarded; on the contrary, if it can be shown that by the substitution electricity can be generated more cheaply, it will aid the progress of that splendid agent. Next, let me remind him that the subject of compressed air, interesting as it is, should not be confused with the transmission of producer gas. It is like saying that, because liquid hydrogen would never be commercially useful, therefore liquid air schemes are doomed to financial failure. Mr. Scott would seem to imply that I mentioned Paris to prove the commercial success of an analogous scheme, but I did not say so. I mentioned Paris in connection with an entirely different scheme from that which I compared commercially with electrical transmission, my object being to illustrate that it would be possible in practice to transmit gas to be delivered at pressures greater than that of the atmosphere. The practical results at Paris (he refuses to accept commercial figures from the "volatile" French city, but he dare not contradict engineering figures obtained by an English expert) prove that there is but little

leakage from the mains. In Birmingham the pipes were well enough jointed to withstand a pressure of over 60 lbs. per square inch, and the leakage proved to be insignificant. Compressed air was mentioned in my article to prove that it would be possible, from a technical (not commercial) standpoint, to transmit producer gas at 1½ atmospheres pressure. The commercial figures were fully dealt with later. Incidentally, the author takes this opportunity of stating that the compressed air schemes—whether financial failures or successes—prove the contention that it is possible to transmit gas at higher pressures than 1½ atmospheres, without any fear of leakage sufficient to cause injury through carbon mon-oxide poisoning. Would the Mond Gas Co. have obtained Parliamentary powers were it otherwise? Let Mr. Scott attack the commercial figures by producing others which prove them to be wrong, and if he is so convinced of this leakage danger, let him support it with "measurements absolute and right down on the nail." To talk of leakage danger reminds one of the old arguments against steam railways raised by a generation who would also attempt to retard progress. I confess that the failure at Brussels was quite unknown to me, and again I would earnestly appeal for figures to form some tangible basis for explanation. Final success is often built upon early failures, of which truism the gas engine is a striking example.

Now let us extract from the extraordinary mixture of serio-comic phrases and Corellian slang the only plausible contention to be discussed. Mr. Scott apparently believes that 2s. 9d. per cb. yd. *complete* for laying the main is too small a figure. If he will give a *reliable figure* for this portion of the estimate, I will willingly accept it, and show that the "line costs" on the gas scheme are well within ·1d. per unit generated, at the low-tension switchboard, while the electrical "line costs" remain—if he cannot give figures to show it otherwise—at ·126d. per unit. The 2s. 9d. which I gave was a figure obtained from actual practice. No doubt it is a vulnerable point, but it was extraordinarily difficult to obtain any guiding figure for this work. As for the remarks quoted from Mr. Earle's paper, which was read at Manchester in 1902, if he refers to it he will find that the Yorkshire Power Co. has four power stations scheduled, and the inference is that, if one station were considered to be best for the system, one station would have been scheduled.

The customers who would, under ordinary circumstances, take three-phase current from the transmission mains would, with a gas transmission line, use power gas to drive direct-current generators; not as Mr. Scott would have it, for driving "line shafting in the bad old way." Is he not here confusing the distribution of power with its transmission? And did not the article which he attacks state explicitly that "electricity is essential for distributing purposes?" Moreover, the customers would not lose by the alteration—always supposing that Mr. Scott cannot disprove the "line costs" estimate, which it is hoped that he will criticise fairly and not superficially. He would have us believe that electrical engineers as a body will quarrel with the author of the article for advancing a scheme for reducing the cost of the B. of T. unit, which will increase the demand for electrical power.

Finally, but still unsupported by figures, he falls back to the old story of overhead wires, and adds some interesting information concerning the officials of the Board of Trade. Let Mr. Scott go to the Board of Trade and ask "the opinion of the officials" concerning the carrying of overhead wires through a large city such as Glasgow or Manchester, where high tension underground cables are used, and if he can obtain their permission for this purpose, he will have achieved something which he himself would hardly dare to expect.

Having finished his inquiries at the Board of Trade let him turn his attention to a subject which causes him great misgivings, the "crownings in," which he would have us believe would inevitably take place. Let him inquire of the gas authorities at Manchester, Birmingham or Glasgow, and obtain definite and reliable data concerning this thing of which he is afraid. Assuming that the danger is real—will an electric cable escape such a catastrophe undamaged?

If additional evidence were required that Mr. Scott has only superficially glanced through the article, it is to be found in the opening and concluding paragraphs of his diatribe without data. The extract from the last paragraph is disposed of most easily—let us consider it first. It reads, "Why, indeed, should we carry a material substance through pipes when we can do all that is necessary by simply vibrating the ether." Has the humorist suddenly wrapped around him the mantle of the prophet? Does he speak of the *wireless* transmission of electricity in bulk? This were, indeed, "rank heresy," and fit only for a solemn and sorrowful penalty, with bell, book, and candle complete. Turning back again to the first paragraph, we read that "Mr. Smith might remain unconvinced out of sheer cussedness, like our friends the gas-lighting people." Mr. Scott is, no doubt, very experienced in estimating costs, but the author would certainly hesitate to lay down the law upon technical matters, and call it "rank heresy" to suggest something which might possibly cause an increased demand for electrical energy; nor does he pursue imaginary "niggers" with the charitable object of "scotching" them, because their skin chances to be not of the same colour as his own.

It was hoped that the subject had been dealt with in an unbiassed manner, for the author's training and work has always been with steam engines, central stations and electrical machinery. None of our theories are perfect, it is at times difficult with the aid of the theodolite or the millivoltmeter to be absolutely exact. If it is to be war—let it be one of figures, not words. Let the critic and missionary produce trustworthy data, not facetiousness resting on nothing more firm than astigmatic views and dark hints of excommunication.

It would be ungenerous to treat Mr. Scott's vague statements in too serious a manner when the whole thing is obviously so hurriedly put together. Let him remember that destructive criticism is easy and its result always retrograde. Let him at least be charitable and not rashly stigmatise as perversity an earnest endeavour to promote a discussion upon a subject of great interest to those engaged upon the cheap production of power. Is it even now too much to hope that some more useful contribution to this important subject may yet be forthcoming?

ELECTRIC PROMOTIONS.—SESSION 190 .

Numerically, the applications for Provisional Orders and Acts in connection with the electric supply business are less than in former Sessions, but they possess features of special interest and significance.

The change in the system of supply due to the adoption of distribution of electric energy over large areas naturally leads to the demand for powers to extend existing areas as well as to provide for further districts not yet covered by the companies who have obtained Acts.

One effect is seen in the action of local authorities as several of them appear to recognise the new order of things by seeking for wider powers in order to carry their supply into districts beyond the limited areas of their own towns.

When the first power companies applied for their Acts they had to accept conditions giving them comparatively limited powers. Supply in bulk to authorised undertakers was the principal concession obtained, with right of carrying their mains through large areas, but often with the restriction that no supply should be given in some districts without consent of the local authorities, so that, although mains could be laid through contiguous districts, the right of supply, even in bulk to authorised undertakers, was made subject to the will of the corporations, urban or rural district councils governing them.

Gradually these restrictions are being modified, and in the applications to be dealt with in next session full powers are being asked for, obviously in the general interest of the public, who will obtain what they want on better terms when the local monopolies give place to comprehensive systems of supply, both wholesale and retail.

The Bills now being promoted by power companies comprise extensions of existing schemes, as well as Bills providing for new areas. Of the former the Lancashire Electric Power Co. ask for the right to acquire provisional orders which would empower them to complete their system by distributing current for supply in detail to all consumers.

The Leicestershire and Warwickshire Electric Power Co. also ask for the right of acquiring electric undertakings by agreement, which would facilitate the transfer to them of many of the provisional

orders held by local authorities and others in their district, which have not yet been worked.

The Lincolnshire and Yorkshire Electric Power Co. seek to generate, transmit, transform and distribute electric energy within the County of Lincoln, the East Riding, and part of the North and West Ridings of the County of York.

Powers are also sought for the transfer to the company by any local authority, company or person, of their authorised undertakings, whether within or beyond the limits of supply.

The North Wales Power and Traction Co., Ltd., or a company to be incorporated, are applying for an Act to produce, generate, transform, convey, store, use and *distribute* within the Counties of Carnarvon, Denbigh (exclusive of Wrexham, and the Rural District of Wrexham) Merioneth and Anglesea, and the Urban Districts of Prestatyn and Rhyl and the Rural Districts of Overton and St. Asaph, in the County of Flint. Power is asked for the transfer to the company of authorised electric supply undertakings, so that the entire scheme of generation, transmission and distribution may be carried out over the large area defined.

Another promotion of a similar kind is that of the Cheshire Electricity and Power Gas Co., which is intended to supply the whole County of Chester. The Bill would authorise the company to acquire provisional orders for electric lighting, and give the right of transfer.

In addition to these Bills dealing with extensive areas, many of the local authorities working provisional orders for electric lighting are applying in next session for powers to supply outside their present limits, the whole tendency being to increase the size of the districts served.

Thus the Rotherham Corporation is promoting a Bill for tramways, in which it includes powers to supply electricity in bulk to neighbouring authorities.

The Shipley Urban District Council wishes to extend its electric lighting area to the Urban District of Baildon, besides purchasing the gas undertaking.

The Wolverhampton Corporation, in a tramway Bill, includes powers to supply electrical energy to local authorities, companies and others in bulk, and to accept a transfer of an electric lighting undertaking in an adjoining district, and to supply therein.

The Watford Urban District Council desires to extend its area of supply to the whole of the urban and rural districts, excluding Northwood and Rinslip, where provisional orders exist.

The Chesterfield Corporation in a Tramways and Improvement Bill, asks for an extension of its electric lighting area.

The Wallasey Urban District Council in a Tramways and Improvement Bill, seeks powers to supply railways and tramways outside its district.

The Huddersfield Corporation promotes a provisional order for extension of its electric lighting area to the Urban District of Golcar.

The Acton Urban District Council, in an Improvement Bill, wants to supply electricity outside its area, although it has done nothing yet with its old provisional order, so far as practical work is concerned.

The Birkenhead Corporation seeks powers to extend its area to Prenton and Upton.

The Isle of Thanet Tramways Co. ask for power to supply Ramsgate from generating stations at Broadstairs and St. Peter's, and for revocation of the Corporation Electric Lighting Order of 1900.

The Maidenhead Corporation seeks for an extension of the area under its order of 1898, so as to supply Taplow, Hitcham, Burnham, Cookham and Bray.

The Bridlington Council has added to the area of its district, and not only requires an extension of its electric lighting order to cover the new boundary, but wants to supply local authorities and others beyond the borough.

The Leyton Urban District Council, in a tramway and general Bill, includes powers for the supply of electricity for all purposes within the Urban District of Wanstead, the supply of neighbouring districts, and a modest demand to "amend, vary, alter or repeal the provisions of the Electric Lighting Acts, 1882-1888."

The Lichfield Corporation, in its application for a provisional order, wants an extension of area to neighbouring townships.

In several cases the applications, both by local authorities, companies and persons, involve the question of transfer of powers, which the Board of Trade have not allowed since 1899.

The action of the department, dictated, no doubt, by a determination to put a stop to trafficking in provisional orders, has rendered negotiations for dealing with the powers difficult in the numerous cases of local authorities who took the powers without intending to work them, but with the view of securing what they believed to be valuable assets of a marketable character.

The only means of meeting the difficulty was by making contracts under the 11th Section of the Act of 1882, with the objectionable provision that the responsibility of the undertakers could not be got rid of.

Attempts are to be made in next session to restore the transfer clause. Among the applications asking for this to be done, is one from Clitheroe, the Corporation asking for "power to enter into contracts for the execution and maintenance of works and the supply of electricity, and to relieve the Corporation from the consequences of any acts or defaults of any such contractors, and power to transfer."

This raises the question of avoiding the operation of the following words in Clause 11 of the Electric Lighting Act of 1888:—

"But no local authority, company or person shall by any contract or assignment transfer to any other company or person, or divest themselves of any legal powers given to them, or any legal liabilities imposed on them by this Act, or by any license, order, or special Act, without the consent of the Board of Trade."

A provisional order for Walton-le-Dale is asked for with a transfer clause.

Applications for Newquay, Saffron Walden, Mansfield Woodhouse, Thornbury, Maldens and Coombe, Keynsham, Ely, Stratford-on-Avon, Whickham, Yardley, Andover, and Kingswood, all ask for the right to transfer or to modify the effect of the 11th Section of the 1882 Act.

Among other notices of interest are those from gas companies seeking powers for supply of electricity. The companies in question are the Aylesbury Gas Co., Barnard Castle Gas Light Co., Ltd., the Chippenham Gas Co., and the Wellington (Somerset) Gas Co.; while the Crystal Palace District Gas Co, in a Bill for changing their name and dealing with various matters connected with the supply of gas, wish to impose upon the Urban District Council of Beckenham what is known as the Bermondsey clause—viz, that their charge for electric energy shall be so fixed that the revenue derived by them shall not be less than the expenditure.

Of course in this matter, the ostensible object is to save themselves as ratepayers from the result of the local authority's municipal trading, although in this case the speculation has been undertaken by a private company working under the 11th Section of the Act of 1888.

The Basingstoke Corporation in a Water Bill imports a clause for supply of electric fittings, and the Plymouth Corporation is bringing in a Bill for an extension of borrowing powers, better provision for audit of the accounts, to extend the periods for repayments of loans and to exclude from calculations of the amount of borrowing powers under the Public Health Act, 1875, all sums borrowed for electric lighting purposes.

The falling off in the number of provisional orders for new districts which are being applied for is probably due to a pause in the municipal trading craze and the position of financial affairs, which does not tend to facilitate fresh loans, and checks private enterprise also.

Electric Lighting Applications.

Abercarn U.D.C.
Acton (Empire E.L. & P. Co.).
Acton (Metropolitan E.S. Co.).
Acton U.D.C. (Further powers).
Andover (Southern District Electricity Corporation).
Ashford (Ashford & District E.S. Co.).
Aylesbury Gas Co., Ltd.
Barnard Castle Gas Light Co.
Bath R.D.C.
Beddington, Coulsdon & Sanderstead (Croydon R.D.C.).
Bexhill Corporation (Extension of powers).
Birkenhead Corporation (Extension of area).
Brentford (Empire E.L. & P. Co.).
Brentwood U.D.C.
Bridlington Corporation (Extension of area).
Bristol Corporation (Transfer of Barton Regis 1902 E L Order).
Brynmawr U.D.C.
Caerphilly U.D.C.
Cannock & District (Whittaker Bros.).
Chippenham Corporation.
Clevedon, Portishead & Long Ashton (Western Electric Distributing Corporation, Ltd.).
Crediton (Christy Bros. & Middleton).
Devizes U.D.C.
Doncaster Corporation (Extension of area).
Eastleigh & Bishopsgate U.D.C.
Ely (Southern District Electricity Corporation).
Epsom (Cheam, Cuddington & Ewell) (County of Surrey E.P.D. Co.).
Gainsborough U.D.C.
Hampton-in-Arden Gas (new Co.).
Hampton Wick & District (Twickenham & Teddington E.S. Co.).
Heysham U.D.C.
Horley (M. H. Bennett & R. C. Quin).
Houghton-le-Spring & District (H. J. Almond).
Huddersfield Corporation (extension of area).
Kettering U.D.C. (supply of fittings, exemption from liability to supply in certain cases, &c.).
Keynsham (Somerset). Keynsham E.L. & P. Co., Ltd.
Kingswood (Kingswood E.S. Co.).
Kirkby-in-Ashfield U.D.C.
Lichfield Corporation (extension of time and area).
Maidenhead Corporation (extensions).
Maldens, Coombe & West Ham (Twickenham & Teddington E.S. Co.).
Maldens & Coombe U.D.C.
Manchester Corporation (Underground sub-station).
Mansfield Woodhouse U.D.C.
Melksham U.D.C.
Milford-on-Sea E.S. Co., Ltd.
Newquay (Southern District Electricity Corporation).
Newton Abbot (Urban E.S. Co.).
North Wales Electric Power (N. W Power & Traction Co., Ltd.).
Penzance (P. & D.E.S. Co.).
Ramsgate (R. & D.E.S. Co.).
Ramsgate (Isle of Thanet E. Tramways and Lighting Co.).
Saffron Walden Corporation.
St. Marylebone Council (borrowing powers for purchase of M.E.S. Co.).
Shipley U.D.C. (extension of area).
Shropshire & Worcestershire Electric Power Co. (certain Mid-Shropshire districts).
Shropshire & Worcestershire Electric Power Co. (various North Worcestershire districts).
Skipton U.D.C. (supply of fittings, exemption of electric supply liability in certain cases).
Southgate U.D.C.
Stratford-upon-Avon Corporation.
Sunderland Districts (County of Durham E.P.D. Co.).
Sutton-in-Ashfield U.D.C.
Swindon (lighting and tramways).
Tamworth Corporation.
Tavistock (T. & District E.S. Co.).
Thornbury R.D.C.
Trowbridge and Bradford-on-Avon (Western Electric Distributing Corporation).
Watford U.D.C.
Walton-upon-Thames Urban E.S. Co.).
Widnes Corporation (alteration of 1901 order).
Withnell Gas Co.
Whickham U.D.C. (transfer of powers).
Yardley R.D.C.

Electric Tramways and Light Railways.

Altrincham U.D.C.
Barrow-in-Furness (tramways and supply of electricity for traction).
Bishop Auckland, Shildon and Spennymoor (United Kingdom Tramway, Light Railway and Elecl. Synd.).
Bournemouth Corporation (extension of time and new lines)
Brighton Corporation (new lines).
Bristol Tramways & Carriage Co. (extensions).
Calverley U.D.C.
Chesterfield Corporation (new lines and extension of lighting area).
Coulsdon R.D.C.
Devonport & Plymouth Light Railways (D. & Dist. Tramways Co.).
Dewsbury Corporation.
Dewsbury & Ossett Light Railways (Yorkshire Elec. Tramways Construction Synd.).
East Cheshire Light Railway.
East Ham U.D.C.
Folkestone Corporation.
Great Yarmouth Corporation.
Guildford Light Railway (West Surrey Light Railway Co., Ltd.).
Harrow Road and Paddington Tramways Co. (powers and transfer to Metropolitan Elec. Tramways, Ltd.).
Mid-Cheshire (Co.).
Middlesbrough, Stockton-on-Tees and Thornaby (Imperial Tramways Co., new lines).
Morley and District Light Railways (Yorkshire (Woollen District) Electric Tramways, Ltd.).
Newcastle-upon-Tyne Corporation.
Ossett Corporation.
Penarth, Cardiff and Dinas Powis (New Co.).
Plymouth Corporation.
Preston and Blackburn (New Co.).
Preston, Chorley & Horwich Tramways Co.
Preston & Lytham Tramways and Tramroad (New Co.).
Radcliffe U.D.C. (tramways and lighting).
Rochdale Corporation.
Romford & District (Empire E.L. & P. Co.).
Rotherham Corporation (tramways and lighting, various).
Saddleworth & Springhead (S. & S. Tramways Co., *abandonment*).
St. Albans Corporation (transfer to St. Albans and D.E.S. Co.)
Snowdon and Bettws-y-Coed Lt. Rly. (N. Wales Power and Traction Co.

Electric Tramways and Light Railways (continued).

Hope & Castleton Light Railway (new company).
Ilford U.D.C. (tramways and lighting)
Isle of Thanet Electric Tramways and Lighting Co. (street widenings in Ramsgate, &c.)
Leeds Corporation (lighting and tramways).
Leyton (U.D.C.) tramways and lighting (various).
Liverpool Corporation (extensions).
Llanelly U.D.C. (transfer of lighting powers of U.D.C., & of L. & District E.L. & T. Co., and tramways of the Llanelly Tramways, Ltd., to B.I. and Helsby Cables, Ltd.).
L.C.C. (various lines).
London, Camberwell & Dulwich Tramways Co., Ltd. (electrical and other powers).
L.U. Tramways Co. (new lines in Middlesex, Bucks & Surrey).
Manchester Corporation (many new lines, also supply of energy to outside authorities, &c.).
Soothill Nether U.D.C. (tramways, generating station, refuse destructor).
Southport & Lytham Tramroad Co. (extension of time).
Stretford U.D.C. (Tramways & Lighting).
Sunderland Corporation (New lines).
Sunderland Corporation (New lines).
Torquay (Dolter Electric Traction Co.).
Tyneside Tramways & Tramroads Co. (Various running powers as to Newcastle, &c.).
Wallasey U.D.C. (tramway & lighting).
Wardle U.D.C. (reconstruction and electrification of lines when acquired).
Watford and District Tramways Co. (extension of time)
West Riding (New Company).
Woking & Bagshot Light Railway (West Surrey Light Rly. Co., Ltd.
Wolverhampton Corporation (Tramways and lighting).

Electric Power, Railway and Miscellaneous.

Baker Street and Waterloo Railway Co. (Further powers).
Barnet District Gas & Water Co. (protection against electrolytic action).
Charing Cross, Euston & Hampstead Railway Co. (Further powers).
Cheshire Electricity & Power Gas Co.
Crystal Palace District Gas Co. (Protection of mains, &c., from electrolytic action; also regulating price to be charged by Beckenham U.D.C. for electric current).
Derbyshire & Nottinghamshire Electric Power Co. (Various powers).
East London & Lower Thames Electric Power Co.
Gloucestershire Electric Power Co. (Stroud, Nailsworth & Dursley).
Great Northern & City Railway (Extension of time).
Incorporation of the Owens College, Manchester with the Victoria University.
Lincolnshire & Yorkshire Electric Power Co.
L.U.T. (1901), Ltd., Electric Railways to connect with the M.D.R. Co.'s Hammersmith Station.
Metropolitan District Railway Co. (Extension of time, subway to Albert Hall, &c.).
Metropolitan Railway Co. (Financial powers, sale of superseded rolling stock).
North & South Woolwich Electric Railway (New Co.).
North Staffordshire Railway Co. (Electric railway and canal traction).
Post Office Sites.
Yorkshire College, Leeds (Merging into the Victoria University of Yorkshire).

Those of our readers who wish to consult the complete notices of any or all of these applications, will find them in the last three or four issues of the *London Gazette*.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week.

Steam Turbo-Generating Plant.

I am sorry to note in Messrs. Belliss & Morcom's last letter a series of assertions relating to the use of superheat in turbines without any attempt at substantiation or the production of a solitary example to support their case, but I am quite content to leave Mr. Wilkinson to defend the statements he has made relative to the use of superheat in turbines and reciprocating engines.

If, however, Mr. Morcom will give figures and specific instances of "*the continual increase of clearance due to wear and distortion*," I shall be very pleased to follow the matter further.

Turning to the Cambridge trials, I am here able to deal with figures and facts. I thank Mr. Morcom for accepting my correction for vacuum, but as yet he does not say how much he is prepared to allow for the absence of a separator near an engine situated (I speak from memory) 75 to 80 ft. away from the boilers. This is surely worth from 1½ to 2 per cent. Prof. Ewing certainly thought so.

Now as to the value of vacuum per inch. Mr. Morcom says I am wrong; he further states I have omitted to notice "the *fact*" that "the benefit or loss per inch increases as the vacuum is reduced." Whilst I must decline to accept the former statement, I willingly plead guilty to the latter. Regarding the table published, I have seen it in full. My first letter to you was based on actual cases which came within my own observation, and to justify my figures I send you a set of curves as follows:—

A, Rankine cycle, showing the theoretical quantity of steam required per KW. at 150 lbs. pressure with varying vacua.

B and C, Consumptions of two turbines under the same conditions of steam pressure and vacuum.

D, Curve of figures from published table.

It will be noticed that my cases follow closely the curvature of the theoretical line. As to D, not only is the curve concave, but if produced to the level of actual atmospheric consumption, 34 lbs. per KW. (as shown by curve C), it shows that there is no difference between atmospheric exhaust and 19 in. of vacuum. I must here leave your readers to judge if I am "wrong."

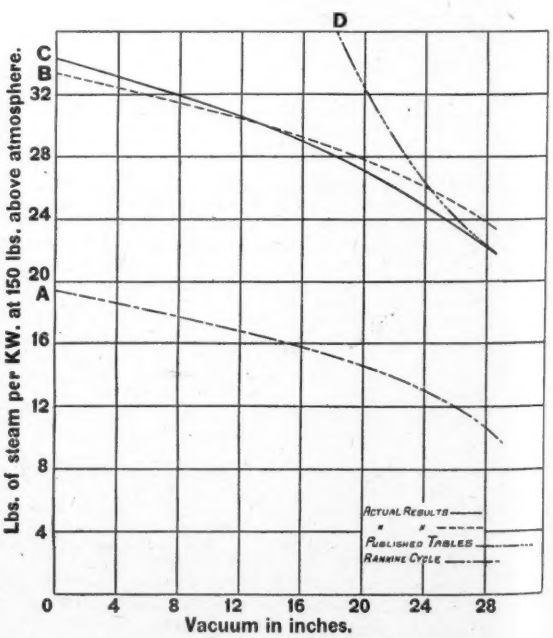
Mr. Minshall's paper gives some interesting results of high speed reciprocating plant. The tests Mr. Morcom refers to are, I take it, on pages 208-9, Vol. cli., *Min. Proc. Inst. C.E.* I sincerely congratulate the builders on such excellent results. For the past year I have been engaged on the design and manufacture of somewhat similar engines, as well as turbines, and can, therefore, fully appreciate the value of the figures. I would, however, remark on these trials that they were both presumably carried out on the same site and under equal conditions as to steam pipes, separators, &c., but after the remarks on my difference of vacuum, I am surprised to find that at full load on the retrial the vacuum was 27·8 against 25·75 originally. Is this worth 4 per cent. per inch?

The average B.H.P. consumption full load is 19·3 lbs. against 19·4 originally, or ½ per cent. better, whereas the I.H.P. consumption was 18·16 against 17·3, an increase of 4·96 per cent. Most engine builders ask for a margin of

Station.	Units sold.	Coal.	Oil and stores.	Works costs.	Load factor.
Steam Turbines:—					
Newcastle-on-Tyne ..	5,537,500	·18	·03*	·38	— † ‡
Newcastle and District ..	1,619,671	·69	·12	1·22	11·66
Cambridge	419,005	·66	·14	1·57	9·13
Scarborough	431,777	·85	·08	1·61	9·34
West Bromwich	285,848	·55	·11	1·10	9·27
		Avge. ·672d.	Avge. ·096d.	Avge. 1·19d.	Avge. 9 85d.
Steam Engines:—					
Leeds	4,442,650	·28	·03	·62	12 31 ‡
Bootle	1,619,129	·41	·03	·70	28·44
Taunton	646,378	·70	·06	1·05	12·77
Yarmouth	418,021	1·88	·23	2 02	9·74
King's Lynn	286,679	·19	·09	1·26	15·58
		Avge. ·968d.	Avge. 1·19d.	Avge. 1·16d.	Avge. 16 63d.

* Assumed. † Not available. ‡ Not included in average.

5 per cent. on the B.H.P. of new engine trials, presumably on the ground that until the corners are ground off, the machine is not complete. Therefore, should not these first trials be reduced by 5 per cent., and so represent the state of the engine after, say, one or two months' running? We should then have a 5 per cent. deterioration in the B.H.P. consumption as well as the I.H.P. Not so a turbine—the I.H.P. to B.H.P. if the former could be measured, is the same at the outset of its life, as at any time thereafter.



Lastly, Mr. Morcom's comparison of turbine and reciprocating stations; I have a very high regard for the excellent tables published by our technical Press on electricity station returns; the friendly rivalry inspired by them has done more to extend Messrs. Belliss & Morcom's and the business of the firm I have the honour to represent, than even the excellency we both claim for our wares. They must, however, be used with judgment and care.

I am sorry Mr. Morcom does not allow an advocate to show that turbines are equal to engines without a charge of *quibbling* (an unkind word). However, I must again appeal to your readers to judge my case. Let us first consider what

we are trying to arrive at :—The merits of steam turbines compared with reciprocating engines for electricity supply under *similar conditions*.

I resign my case unreservedly for three stations Mr. Morcom selects. Steam turbines cannot compete with reciprocating engines as regards economy of steam, unless they are, first, condensing, and secondly, of units over 200 H.P. On these grounds I am sure Mr. Morcom will allow me to strike out Blackpool and Morecambe from his list on the first ground, and Melton Mowbray on the second. I have been fortunate in obtaining a copy of the report of the meeting of the Newcastle-on-Tyne Electric Supply Co., which has the largest installation of turbines in this country, and from it I take the cost of coal, works costs and output. This brings the turbine stations up to five. The reciprocating stations must be reduced accordingly. I delete Halifax corresponding to Blackpool, and as Salisbury is partly a *turbine* (water) station, I think I may also omit that. Darwen is a continuous current and battery station, and hardly comparable with Scarborough. A watering-place of exactly the same output is afforded by Yarmouth. I have added a column of figures, of the value of which Mr. Morcom may not be aware—namely, load factor, and omitted total costs, as management, rent, rates and taxes hardly concern steam engines.

The result of my table is to show that a station which was all reciprocating and of a power of 3,000 KW., in one year, by adding 4,000 KW. of turbo plant, reduced its costs for coal from ·48d. per unit to ·18d., and works costs from ·98d. to ·38d., holding the record for all Great Britain.

Of the remaining four stations, three turbine stations are superior in coal, whilst the load factor of the corresponding four reciprocating stations is 70 per cent. better. The cost of "oil, waste, water and stores" is hardly comparable, including, as it does, boilers, dynamos and mains. The same may also be said of repairs and renewals.

I trust my quibble may be pardoned, and I think my reading of the published results of such turbine stations as exist, when compared with the same number of as nearly equal conditioned reciprocating stations as I can find—80 per cent. of which are also selected by Mr. Morcom—goes to prove that the distance ahead of the steam engine is undoubtedly uncertain, and is possibly represented by a figure with a minus sign in front.

John H. Barker, M.Inst.C.E.

Loughborough, *November 30th*, 1903.

While I am quite able to defend and maintain my position on the above matter, provided the controversy is carried out on fair and legitimate lines, I beg to protest strongly against the tactics resorted to by Messrs. Belliss & Morcom, Ltd.

In the first place, although at the outset of my last reply I frankly accepted the correction they made as to the steam consumption of their Leeds engine as given to me by the city electrical engineer (small though that correction was), and also expressly declared that the figures given in my paper were, to the best of my knowledge, correct, Messrs. Belliss ignore these facts and insert the following inaccurate statement in their letter :—"We called the statements extracted from his paper misleading because these incorrect statements were largely used in his argument. As he does not in his reply dispute the inaccuracies, the previous letter still applies to the facts."

After this apparently wilful or careless neglect of facts, I trust Messrs. Belliss will cease to make reference in general terms to alleged inaccuracies on my part unless they point out exactly where the inaccuracies are.

The difficulties which Messrs. Belliss suggest with regard to working turbines with steam superheated within practical and economical limits are purely imaginary, and appear to indicate a very restricted knowledge indeed of the subject under discussion ; perhaps it will be useful to state for their information that the clearances in the turbine are arranged to allow for expansion due to superheat, and if on occasion saturated steam is used, the economy is not let down to any greater extent than in the case of reciprocating engines designed to run with superheated steam, running on saturated steam, and probably not so much. Exactly what is meant by the "maximum possible superheat" I am unable to say, but it is an undoubted fact that turbines give no trouble when working with superheated steam, whereas the troubles with reciprocating plants on high superheats are many.

It is true that I prefer to compare results "under actual daily working conditions" and to have "the outcome of every day practice," but the table inserted in their letter gives neither one nor the other; there are so many additional factors controlling the figures given therein as to render them valueless and irrelevant to the subject under discussion.

Two points only I will mention in connection with the tables given by Messrs. Belliss & Morcom.

1. The stations named as employing reciprocating engines are in every case much larger than the turbine stations with which they are compared, and almost without exception have a much better load factor.

2. Every station named as a steam turbine station was at the time covered by the figures given, employing obsolete turbine plant, excepting West Bromwich, which at that period was quite a new works ; Shipley, another modern turbine station, is not mentioned at all, and the costs at both these works will compare very creditably with the costs given for the works employing reciprocating steam engines.

I will, however, submit a proposal to Messrs. Belliss which is quite relevant to the present controversy, viz., that Messrs. Belliss select any 300-KW. alternating current plant running on superheated steam and driving its own condensing plant, and of which they have manufactured the engine. The plant selected shall have been in daily work on a lighting or traction load for the past two years without any renewals or repairs to the pistons and valves. This plant to be tested on full, half and quarter loads by an independent engineer. I will arrange to place a steam turbo set of the same output and which fulfils the same conditions, at the disposal of the same engineer for a like test, and the steam consumption per kilowatt output on both tests shall be published in the technical press. It shall be a condition of this contest that both Messrs. Belliss and myself shall have representatives present at the tests.

In conclusion, will Messrs. Belliss say what extra clearance they give piston valves for 600° F. superheat ?

Geo. Wilkinson.

Harrogate, *November 30th*, 1903.

It would be an interesting contribution to the controversy at present proceeding in your columns on the relative merits of steam turbines and reciprocating engines if someone would explain the reasons which have induced the authorities at Blackpool to go in for reciprocating engines of the "high speed self-lubricating type" for their present extensions, after using steam turbines exclusively for so many years.

Truth Seeker.

Groundless Fears.

Travelling to-day on the City and South London underground electric railway, I noticed that the fittings holding the incandescent lamps in the interior of the car are alive, and I was informed by the attendant that he is in the habit of receiving shocks in "almost all the cars" sufficient to throw him on the floor. I do not want to alarm the public, but think attention should be drawn to this state of things, which may be due to bad wiring. If it is, some very serious calamity might happen, the nature of which I need not point out. The cars, being constructed mostly of wood, fit very closely to the shape of the tunnel, and there would be no possibility of getting out, should this appear desirable. Perhaps this letter may cause the engineers responsible to put things right in time to prevent serious accidents.

G. E. Heyl-Dia,
Consulting Engineer,

Stretton, near Warrington,
November 25th, 1903.

[Our correspondent appears to have been the victim of a hoax on the part of a gossiping conductor. We have personally investigated the question, and are satisfied that his fears are groundless. On account of the importance of the matter, we have fully dealt with it in our leading columns.—Eds. Elec. Rev.]

The Parallel Running of Alternators.

I should like to make a few observations on Mr. Hopkinson's remarks, on the influence of frequency on the parallel running of alternators.

Mr. Hopkinson commences by quoting me correctly, but, as he goes on, he inverts the substance of my remarks, and thereby extends their scope further than I intended. I did not say that two generating sets, differing only in that one has double the number of poles as the other, may be expected to perform equally well as regards the effect of uneven turning moment, but that, in view of the information at present available, there is no reason to think that (as is commonly stated) one of the sets ought obviously to run better than the other one. Possibly further research may afford such reasons, but, as things stand at present, I think that the matter should be regarded as an open question.

The whole question of the "practical rule," of course hinges on whether the proviso assumed by Mr. Hopkinson—viz., that the angular deviation, due to uneven turning moment, is the same when coupled to bus-bars as when disconnected—is justified over the wide range of actual practice. If this be so, I agree with Mr. Hopkinson, that the low frequency set ought to operate the better. But is there yet any reliable evidence that this condition is usually fulfilled in the case of actual generating sets of ordinary proportions? Has the natural period of actual large machines been determined experimentally, by which I mean determining the displacement-torque curve experimentally, as, if this is known, the matter resolves itself into a simple mechanical calculation? To calculate the natural period from the constructive data of a machine is a complicated process, and, in the absence of comparison with experiment, it is difficult to say how far such calculations can be relied upon. My own estimates of the natural periods of a number of existing large machines, calculated from such data as happened to be available, tend to show that the natural period is not so different from the period of a component of the turning moment curve as to enable one to accept the above-mentioned proviso without further inquiry. But I submit that the matter ought not to be regarded as settled without experimental data of actual displacement-torque curves, as this would eliminate a mass of calculation.

As bearing on the general question, I may describe an experiment on the cyclical variation of speed of a 1,000-H.P. slow speed generating set. A sensitive tachograph was employed which recorded to a small scale the cyclical variation of speed during each revolution of the engine. The set was first run by itself on a water resistance and a tachograph record taken. Immediately after, the set was paralleled on the station bus-bars with others with which it ran satisfactorily in parallel, and it was then loaded up to the same amount as before. The tachograph then showed a very much increased cyclical variation. I have not, at the moment, got the curves at hand for reference, but, as far as I remember, the proportion was about double. That is to say, the angular deviation, when coupled to bus-bars, was about twice as much as when running disconnected.

A general conclusion cannot, of course, be drawn from an isolated observation of this sort, but this will, at least, serve to show that practical cases do arise, in which the conditions are very different to those implied when the "practical rule" is made use of.

H. C. Leake.

Plymouth, *November 29th*, 1903.

Fair Trade?

I have the honour at present of representing a German firm of electrical engineers in England, and a few days ago we had the pleasure of quoting a North of England firm for a number of three-phase motors. The party in question informed me at our first interview, that the only thing they were disposed to give to a German would be a kick (the word "kick" being preceded by some flowery language not usually found in Nuttall's), and the only thing that would induce them to give the order to a foreigner, or in other words, the price of their patriotism (?), would be about £100. That is to say, our price for the machines would require to be somewhere about this amount less than the lowest tender submitted by a native. As our firm is not given to indulging in what our Protectionist friends call "dumping," we quoted the machines at a fair price. This price, however, did not appeal to our clients as being of the dumping-down order, so the order for the machines was passed on to a very old-established firm of electrical engineers whose works are not a hundred miles from St. Paul's, but, unfortunately, the said works are not capable—or is it the designers?—of turning out three-phase motors. Don't presume, however, that they are incapable of executing the order; on the other hand, they will deliver the machines much quicker than if they had commenced making them themselves. They at once pass the order on to their dear friends (curse them) in the Fatherland, who probably have sufficient standard machines of this type in stock to despatch at once to the North of England, *viâ* London, of course, at which place they find a resting place for a day or so to receive the *British* finish in the shape of the name plate of our old-established friends. "What's in a name"? the poet said. Not much, perhaps, but a nameplate is a most important item in the manufacture of an electric motor.

I have heard of a lot of different kinds of trade lately, such as "Free, Fair and Fairer Trade," but I should like to hear what Mr. Chamberlain's supporters would call this—I was going to say new form, but as the majority of electrical engineers know, it is not new, as I could mention more than half-a-dozen well-known British firms who are doing the same thing, viz., getting the highest price from their clients, who think they are supporting home industries, when they are simply putting more profit in the pocket of the British employer, and less work in the hands of the British employé. I must apologise, dear Mr. Editor, for trespassing so far on your very valuable space, and at the same time thank you in anticipation for inserting this letter.

Fiscaliteur.

Waste of Energy in Tendering.

As manufacturers of electrical machinery, we have read with interest the letter of Mr. Dykes on the above subject, and, as his proposal seems to us unjust to his clients as well as to manufacturers, we should like to make a few remarks thereon.

First, we fail to see the reason of the discussion being started. We are not aware that this was done by anyone at present connected with a manufacturing firm; and, though manufacturers may see the expenses of their estimating departments growing as a result of "cross tenders," we believe that they have not grumbled, and look upon it as one of the necessary expenses entailed in the getting of business.

Secondly, let us ask Mr. Dykes how, if his idea had been a *fait accompli* 10 years ago, he would have liked it if the firm he was then managing had not been among the chosen six for certain jobs that they got?

Thirdly, suppose users of electrical plant were to turn round and form a "ring," and say they would only ask for advice from one or other of a list of six consulting engineers, and Mr. Dykes's firm was not on that list, how would he feel then? He would probably have the mortification of seeing the names of men on that list who had a much inferior training than himself, and had little or no experience; and why?—because they "advertised" in some of the artful ways known to some consultants, "did the heavy," and "gassed" a lot.

The position Mr. Dykes might then occupy would be analogous to that of manufacturers who might be barred if his own suggestion were carried out.

The suggested monopoly of six is unfair to the purchaser, because it is open to these manufacturers not to quote the lower prices they would if they were in open competition. It is also liable to increase prices if those six put their heads together.

Further, the consultant tends to stultify his own knowledge, as, were the job open to competition, there might be some firm who could show better results on tests, or more advanced methods of construction, &c., than any of the "six."

As "R. A." says in his reply, the six would probably be the biggest firms—in other words, "Protection" for those who are big enough, or sufficiently known to, or able to ingratiate themselves with, this or that consultant.

"Duncan Watson" is quite refreshing in talking of th

"existing evil." Things must have altered a lot if sending a guinea or two, obtaining a specification, and spending hours in estimating, &c., in a genuine attempt to get work are thus to be described!

The instance Mr. Dykes gave of a contractor coming in with a price after all tenders were "in" is not a new departure, though fortunately rare, and [the engineer, in cases that have previously happened, has generally informed his client and then returned the previous tenders to each firm, with a note giving the reason and asking for fresh estimates; this, to our mind, is the only fair way.

Summing the matter up, it seems to us that, if the consultant is to do the best for his client, he certainly ought to put specifications out to open tender, thereby getting the lowest price and finding out new ideas or methods as previously mentioned. The job should be given to the lowest tenderer provided he can demonstrate to the consultant that he has carried out similar work before satisfactorily, or that he can show by an inspection of his works, designs and methods of manufacture, coupled with any cross-examination the consultant may care for, that he is able to carry out the work satisfactorily, although he may not have done anything quite as large before.

In conclusion, might we suggest to some consulting engineers that it is hardly a gentleman's action or courtesy to receive tenders for plant, never acknowledge them and never let the tenderer know to whom the job has been given.

Again, in the case of the lowest tender not being accepted, in common fairness to that tenderer he should be informed of the reasons why his tender was not accepted.

X.

[Messrs. Duncan, Watson & Co. have sent us a copy of certain recommendations passed by the Institution of Heating and Ventilating Engineers last year, with a view to obtaining uniformity of practice in the preparation of plans, specifications and estimates, and checking the evils arising from the variable and uncertain methods of obtaining tenders for work. The Institution recommended that contractors should decline to tender unless they were supplied with scale drawings free of cost, and that contractors invited to tender for work done should be paid out-of-pocket expenses for travelling, &c. After the sealed tenders had been opened, all at the same time, no other tender should be considered; tenders might be withdrawn in case of error, but in no case amended. If guarantees were required, the individual who prepared the scheme should alone be held responsible. Architects should see that the terms of agreement were equitable. Payments should be completed within six months of the completion of the work.

These recommendations are obviously perfectly equitable and just, and, we understand, have had most beneficial results. It is not long since the Institution of Electrical Engineers devoted much time to the compilation of a somewhat similar code of model general conditions; whether these have been availed of to any great extent we cannot say, but there can be no doubt that the question needs further attention.—Eds. Elec. Rev.]

Variable Speed Continuous-Current Motors.

Referring to my old friend, Mr. Ralph's, letter *re* the above, I do not think there can be any difference of opinion between us as to the value of speed control.

For the work he describes, which I take to be in connection with special machine tools, speed control over a wide range is the first consideration. In most machine-tool shops speed control is of more importance than economy of power. The cost of power in such cases bears so small a proportion to the total costs of the product that even a saving of the whole cost of fuel might not be so great an advantage as an increase of 25 per cent. in output, and this can be obtained by careful design of the speed regulating arrangements.

The point I wished to emphasise was, however, that there is a tendency to put wide speed control in the forefront on every possible occasion, and push special and complicated systems, when the desired results can be obtained with standard apparatus.

I am still of opinion that for the usual run of either machine tools or printing machines a speed range of 2 to 1 in the motor meets most cases. In many cases this permits of a range of 4 to 1, as a printing machine can be "double-rolled," and a machine tool back-geared.

If in a special case the motor has a double-wound armature, a range of 8 to 1 is then possible, and with a three-wire system 16 to 1, and all this without recourse to anything in the way of needless complication.

In penning the short article to which Mr. Ralph refers, I had in mind cases in which costly and unsatisfactory speed controlling arrangements have been fitted where no variation of speed is required, although the works owners had been persuaded by the electrical engineers that it was necessary.

This is in a printing works. The manager, a man of some 30 years' practical experience, tells me that he can do almost everything on one speed, and when he has special work on, requiring a slow speed, he can "double roll" his machines, and work at half speed for that particular job.

Before he adopted electrical driving, he had already thrown out his speed cones and substituted plain pulleys, and in his opinion most other printing works could do with one speed by proper management. After a few years' experience of electrical driving, he is so absolutely convinced that variable speed control is a costly fad and a delusion, that he is going to throw the whole system out, and revert to the one-speed arrangement.

And this is in a office turning out all kinds of work, from the finest three-colour work to plain bill heads.

Now, whilst I recognise to the utmost the enormous advantages offered by variable speed motors, it is useless to attempt to push speed control down the throat of a man who will prove to you, out of the month of every machine-minder in the place, that with the option of a dozen speeds about 90 jobs in every hundred are run on one speed, and the odd 10 per cent. can be got by "double rolling" the machines.

Frank Broadbent.

4, Queen Street Place, E.C.,
November 30th, 1903.

Single-Phase Traction.

To your editorial, "Electrical Traction on Railways," I beg to offer a few remarks. The Union motor, that is, a series-motor with compensating brushes and with a special low-tension speed control, is there introduced as the only motor which fulfils the seven severe conditions you impose.

Now, as to my own motor:—

1. The conductor is single, and does not interfere with the tracks.

2. The primary voltage is high—5,000 to 10,000 volts if necessary—so that all the energy necessary for fast trains can be collected.

3. The system is suitable for main lines and for suburban traction, and two or more working pressures can be used.

4. The system lends itself to use on locomotives, motor-cars or multiple-unit trains.

5. The controllers are on the low-tension *exclusively* and their handling is no matter of skill.

6. The acceleration has been compared size for size with that of the best direct-current motors and found equal *in practice*; the power factor will be mentioned later in this letter.

7. The motor reverses and brakes, *and can take direct current* from special lines or from batteries.

These statements are only a corollary from my article in the Electrical Review, November 6th and 13th, and I, therefore, was surprised to see that your article had been drawn to convey the impression that the Union motor fills those conditions for the first time. The fact is, that the greatest part of your statements apply with equal force to my motor.

As to the power factor, we have only the vague statement that the complete Union system would *probably* show a power factor in the neighbourhood of 0·9; I have experimentally proved that for a much smaller output (30 H.P.) the global power factor averaged 0·8, so that the difference between series motors and compensated motors is not a demonstrated fact yet. A theory by M. Osnos further shows that the short-circuiting brushes do not assure a unit power factor generally, and that such compensated motors are—as regards the power factor—subject to limitations

from the frequency and from the air-gap even as any simple series-motor is.

For all commutator motors the frequency will be chosen lower in practice when the output of each motor is greater; 40 cycles may be consistent with a 40-H.P. motor; but to say that any periodicity can be used as far as the motor is concerned, is to equivocate unless the curves of, say, 125-H.P. equipment for 40 cycles be shown.

The same holds as to the commutation; it is well-known that the commutation difficulties of a simple series-motor disappear *at synchronism* in a compensated motor; but *for any other speed* the difficulties are simply *shifted from the series brushes to the short-circuiting brushes.*

Dr. George Finzi, M.I.E.E.

Milan, *November 24th*, 1903.

[We have much pleasure in inserting this letter from our esteemed correspondent, whose courtesies to the British Electrical Engineers on their visit to Italy will not soon be forgotten by those who enjoyed his acquaintance. Although we have seen Dr. Finzi's motor in his works, we have not seen it running under load, and cannot, therefore, speak of it with the same confidence as of the Union motor. We need not say, however, that no one will be better pleased than ourselves when, as we hope, we are able to write as favourably of Dr. Finzi's motor.—Eds. Elec. Rev.]

What are we coming to?

I cannot refrain from addressing a word or two to you on the subject of the following advertisement which appears in your current issue :—

WANTED.—An Improver to arc lamp trimmer. Person appointed will have opportunity of learning other branches of outside work. *No wages to commence.*

When one reflects upon the electrical status of the average arc lamp trimmer, the amount of wages the job is usually worth (lucky man who gets 30s. per week), and the fact that any amount of proficiency in this work is *not* regarded as a qualification for higher and more remunerative branches, one is amazed at the remarkable effrontery of the offer. The literally nominal salary of nothing for what is regarded in electrical circles as practically unskilled labour! What are the "other branches of outside work" so ambiguously referred to in the advert.? Washing the globes, presumably, or, by way of change, painting the standards.

Oh, sons of gentlemen throughout the length and breadth of this tight little island, give ear unto the appeal! Here is a sinecure awaiting the asking. You only need good references, a capability for hard work, and you will be welcomed with open arms into this cathedral city, where you may fatten on the lavish emolument of nothing per annum.

What *are* we coming to?

M-arc-us.

Arc Lamp Litigation.—Jandus Arc Lamp and Electric Co., Ltd., v. Arc Lamps, Ltd.

The trial of the above action, which the Jandus Co. have widely advertised as brought against us for infringement of their patents, has been postponed solely on their application. We were fully prepared, and expected that the case would have come on for trial last week; this would have been so but for the application made to Mr. Justice Kekewich on 18th inst., when counsel on behalf of the Jandus Co. stated that, as his clients had come to the conclusion that neither of the patents sued on in the action could be supported in their present form, it would be necessary to apply to amend both specifications, and for that purpose the trial would require to be postponed. To this course the judge (Mr. Justice Kekewich) consented on the following terms, viz.:—

1. No further advertisements or threats to be issued by the Jandus Co.
2. No claim to be made by them for damages for any infringement up to the date of order.
3. The costs of the application and all costs occasioned by the Jandus Co., having sued on invalid specifications, to be paid by them to our company in any event.
4. All amendments to the specifications (which can only be by way of disclaimer) to be made within four months.

We shall prosecute with all possible speed our defence in this action, and endeavour to bring the matter to a satisfactory end as speedily as possible.

In the meantime, the indemnity which we have already given to our customers will be continued in respect of all lamps supplied, or to be supplied.

Arc Lamps, Ltd.
W. J. Davy.

London, E.C., *November 27th*, 1903.

Technical Instruction.

I do not know, nor yet care, whether your correspondent "Arc" ever received an education at a technical college, but his absurd letter in this week's Review shows that he does not know much about the methods of those institutions. Does he really suppose that the whole instruction given at these colleges consists of the rubbing of glass with cat's fur and the expert manipulation of pith balls? If so, let me inform him that he is mistaken. This gentleman, too, must have come across a remarkable set of individuals in the course of his career. He has never met anybody, who has received such technical instruction, who is able to apply Ohm's law to practical problems.

What a remarkable thing! Mr. Swinburne wisely said that science must be a "knowledge of nature as utilised by man." Your correspondent admits the truth of this statement, yet "a simple process of reasoning" drives his keenly observant mind to the conclusion that most of the technical instruction in this country is an absolute farce. Dear me! However simple this process of reasoning may be, it is too complicated for me. Would this gentleman like to have all technical instruction abolished? Let me state that the colleges in this country are formed to give instruction both in theoretical and practical science. He will find them fitted with workshops and laboratories, as well as with lecture rooms, where the "pith ball exercises" are taught. True, these fundamental exercises and experiments may be of no practical use to the student in his future career, but, nevertheless, everyone must start at the bottom of the ladder in any profession, if success is desired. It is useful to the student to know how the laws, which he is taught, were found by simple experiments, and these give him an insight into the methods adopted by the great men of science, who, by such simple experiments (which "Arc" classes as useless knowledge) have built up the practice of engineering. The student must learn "cause and effect." The knowledge of one alone is useless. A man cannot learn everything by theoretical knowledge alone, nor yet alone by practical experience. Surely, the true knowledge of nature consists in the true knowledge of the cause and effect of her phenomena. I will not go further into the matter, but will state that Lord Kelvin recently said that the student in engineering ought to spend half his time of study at the University and half in the workshop. It is this man who deserves the appointments, about which "Arc" complains, and not the man who is crammed alone with theoretical or practical knowledge. I, therefore, think that "Arc" has gone a little too far in saying that the former is a "human encyclopædia of useless information."

W. L. Turner.

I read with interest "T. R.'s" letter and also your remarks *re* the above in this week's issue.

My experiences in connection with an appointment as workshop instructor at one of the metropolitan polytechnics may be of interest and tend to prove why technical instructors receive such comparatively small salaries.

On two occasions I applied for the appointment of workshop instructor in "house wiring and fitting" at one of the metropolitan polytechnics, but was unsuccessful, although each time I was selected to attend before the governing body.

The appointment was again open this summer, but before it was advertised I was approached by the principal with a view to ascertaining whether I was still available. Being so I replied, and subsequently attended, with one other candidate, before the governors. My opponent, who was successful, is a fairly well-known consulting engineer, who is in practice as such.

It may interest you to know that the fee for the term (one night a week) works out well under £1 per week, and

without troubling you as to the duties and requirements of the appointment or my qualifications for the same, I may only say that I am convinced that a skilled electrical mechanic could fulfil them, and that at least I claim to be.

If, therefore, technical authorities can procure consulting engineers willing to receive shillings per week for their services as workshop instructors, is it not unreasonable to expect them to pay adequate salaries to instructors and demonstrators for the higher-grade appointments?

In conclusion, may I ask—presuming that consulting engineers, acting with philanthropical views of improving future electrical artisans, take up these minor appointments—would it not be more in keeping with the dignity of their profession if they held the same without remuneration?

Rejected.

Heating Capacity of Electric Radiators.

We have read with interest the correspondence on the "Heating Capacity of Electric Radiators," together with the editorial note in your issue of to-day. You say, "Radiators compete only in durability, elegance, convenience, prime cost and similar features; on the score of efficiency one is every bit as good as another."

Taking the word "efficiency" in its broad sense, we venture to differ from your opinion, since a radiator which thoroughly warms the air in a given space without scorching it or taking the moisture from it, can surely be considered more efficient than one which has these objectionable features. In this direction we claim greater efficiency for the radiators made under our system, which provides for a large heating surface and a comparatively low temperature (about 180° F.).

For a parallel we may consider the question of heating by hot water pipes as opposed to steam pipes, a question which has often been discussed, and in which the former method seems to have the greater weight of popular opinion.

The Electric and Ordnance Accessories Co., Ltd.,
R. F. Hall, *Manager.*

Birmingham, *November 27th*, 1903.

[We appreciate the view of our correspondents, who distinguish between a radiator working at a high temperature and one at a low temperature. But why are these things called "radiators?" It would seem that they ought to be called "convectors," for on this view they act by convection rather than by radiation. It is evident that the same volume of air passed slowly through a low temperature apparatus can be heated to the same extent as if it were passed rapidly through a high temperature apparatus; but though the "relative humidity" of the air will be reduced by the warming operation, the amount of moisture present cannot be altered, whichever method of heating be adopted. If the "relative humidity" of the air is to be maintained unaltered, water vapour must necessarily be added to it artificially, no matter what system of heating be employed. As for "scorching" the air, while we do not dispute the possibility of affecting its taste or freshness by over-heating, we doubt whether this effect is ever met with in practice.—Eds. Elec. Rev.]

With reference to the letters appearing in your last issue, we at once plead guilty to the great crime of having a printers' error in the list in question. The word "radiator" ought to have been used instead of "lamp." In the first issue of the price list the correct word is used.

To Messrs. Verity our apologies and thanks are due for calling attention to the unfortunate mistake.

We agree with you that the statement of "80 per cent. efficiency" and "the requirement of ½th of Board of Trade unit" are meaningless; but, on the other hand, we must ask you to pardon us for differing from you in your statement that "on the score of efficiency one radiator is every bit as good as another."

It might as well be suggested that with an equal consumption of current, one motor, arc, or incandescent lamp, is as good as another. What we state is not at all "preposterous." We claim, and maintain, that owing to its construction the Phœnix heater must have a superior efficiency, and that there is no electric heater on the market that can be repaired quicker or at less cost.

We do not expect to convert our opponents, but the importance of heating by electricity is so great that we make the following proposal:—Let any maker of electric heaters supply a heater for comparative tests; the cost of same to be borne by the unsuccessful competitor. You, Mr. Editor, to appoint a suitable expert and to fix the conditions. Of course it is understood that all competing stoves must consume or "dissipate" the same number of watts. The result would show the best heater on the market.

Falk, Stadelmann & Co., Ltd.,
G. E. Sare.

London, *December 1st*, 1903.

Electric Shocks on Flat-Back Switchboards.

I think that "H. W. C." could with advantage have made his remarks in your last week's issue somewhat clearer, and more to the point. He states that:—

"It must also appeal to many engineers in this country with a sense of gratitude to our British firms who, in spite of the extra cost thereby involved, have set themselves steadfastly against switchboards with backs and such-like dangerous places."

There should certainly be as few "dangerous places" about a switchboard as possible, but it is a matter both of opinion and experience as to what constitutes a "dangerous place." It is certainly a truism that the more space you can allow for, and the more open to inspection you can make switch-gears, the better; and therefore, for low-tension switchboards, it is certain that a "flat-back switchboard," round which there is a *clear passage-way* for the engineer-in-charge, has a considerable advantage over a "cellular backless switchboard," which is generally built into the wall in such a manner that the parts which carry current are hidden away from view, and cannot be got at without dismantling a considerable portion of the switchboard. The above must hold good to an even greater extent with a *properly designed* flat-back high-tension switchboard if all current-carrying parts are inaccessible from the front, *i.e.*, from the position of ordinary control, and if the back of the board is built up in the form of a chamber or room, to which authorised and competent persons only have access, for the purposes of inspection, &c.

The matter of "ease of repair" is a point which, apparently, "H. W. C." has not borne in mind in his advocacy of cellular backless boards, as it is an obvious fact that repairs can be more easily made to gears that can easily be inspected than to those which are confined in a small built-up space (and accidents, due to carelessness, &c., can, and do, occur with both types of boards).

On one point I am in entire agreement with "H. W. C.," and that is in his condemnation of wooden frameworks; but I trust that he is not under the impression that all, or even the majority, of flat-back boards are built on wooden frames. This, I can assure him, is an entire mistake.

Percy B. Hall.

Prestwich, *November 28th*, 1903.

Applicants Please Note.

I notice in your last issue, under the above heading, some notes of advice to electrical engineers desiring to change their positions.

While quite agreeing with "Selection" in his remarks *re* stating full particulars as to age, training, &c., I think that these particulars would be furnished in a fuller manner if the applicants had occasionally some reply from the companies advertising.

I may state, in my own case, I have recently been endeavouring to improve my position, and in the course of my endeavours I have had occasion to answer a large number of advertisements. The proportion of answers I have had is very small indeed, and I think it must be very disheartening to any applicant to be treated in the same way. I would therefore ask, through the medium of your columns, that advertisers should have the courtesy to let their applicants know the result of their applications.

Unanswered.
E

Cheap Labour.

After reading for many weeks the advertisements for "Persons Wanted" in the ELECTRICAL REVIEW, I have come to the conclusion that it would be to the benefit of everyone if there was a clear understanding as to the meaning of Assistant, Junior Assistant, Improver, &c. Take, for instance, the case of a small town with the corporation owning both the gas and the electrical concerns, they have one committee and the gas manager attends the meetings, and there is the *so-called assistant* who attends to all electrical matters; in this case *who* advises the committee on electrical matters if the manager is only an authority on *gas?* Would it not be better to give credit to the assistant and give him the name of electrical engineer?

Then there are advertisements for "Shift Engineers" at 27s. per week, and in one case I noticed it was only 24s.; if a firm want a labourer they should state that, if an *engineer* with electrical knowledge as well, I am sure they can afford to pay more than the above. There must be a wide meaning in the term "engineer," or is it that our trade is crowded out with men who accept these small salaries for the sake of having the name? Surely an *engineer* would not be attracted by the great amount of money offered by *some* firms.

It is not often I see an advertisement for an *improver* to an *arc-lamp trimmer*, but such a person is "wanted" in last week's ELECTRICAL REVIEW; the salary offered is *nil*, but I suppose the experience to be gained is splendid. If a firm are losing money it is no reason why they should expect their work done for *nothing;* most, if not all, of the paying concerns of to-day pay the largest salaries and they get a good return.

I should very much like to hear the opinion of others on this subject, especially those who can *exist and keep happy on nothing*.

S. C. M.

Kendal Electricity Works.
December 1st, 1903.

Design of Direct Current Machinery.

Having read with interest Mr. Fynn's first instalments on the "Design of D.C. Machinery" I should like, if you will permit me, to ask one or two questions regarding the particular type of carbon brush gear which he advocates, and an illustration of which was given in last week's REVIEW, viz., the inclined type for machines which run continuously in one direction. Mr. Fynn states that the commutator should rotate *against* the inclination of the brush. Now, although I have often heard this question discussed by engineers, I have never heard a really satisfactory reason given why this method should be adopted in preference to running *with* the inclination. As far as my limited experience goes, the former method always seems to give rise to more noise, and also to require more pressure to be put on the springs to ensure the brushes making efficient contact. However, no doubt Mr. Fynn will be able to clear this point up for me, if he will kindly spare time to do so.

Willing to Learn.

The Multiple Supply System Patents.

I note in your issue of to-day a communication from Mr. C. H. R. Thorn regarding the patents on the multiple supply railway system. If Mr. Thorn refers to his British patent No. 2,393, 1903, which contains some points of interest and value, he will find that all of these details were patented long before the date of his application, and that pending patents on the system refer to matters in no wise relating to his invention.

Multiple Supply.

November 27th, 1903.

Refuse Destructors and Electricity Works.

I am obliged to you for the notice you have taken of my letter. The question of combined works is only involved so long as it is dealt with as between electricity department and destructor department, instead of from the broad standpoint of gain or loss to the community.

I am obliged to you for your kindly hint not to forget that boilers, economisers and steam pipes are not required in a destructor; it is a small matter, but to the point, that *a* boiler is a necessity in a modern destructor.

I will also endeavour not to forget that boilers, steam pipes and economisers are *sometimes* used in electricity works, that both electricity works and destructors require chimney stacks, buildings and land space, that where steam is obtained from the burning of refuse wages are saved in stoking boilers with coal, and that a manager is needed to superintend both works, to mention only a few of the points needing consideration when the advantages or otherwise of combined works are being discussed.

W. P. Adams.

[We agree that the community gains as a whole; but we have pointed out that it is at the expense of the electricity department, which is erroneously supposed to benefit by the combination.—EDS. ELEC. REV.]

[NAMES OF MAKERS WANTED.—A correspondent wants to know the name of the agents for the Bayliss patent carbon brush holders in this country. Another asks for information as to the makers or patentees of Dr. Timms's electric furnace for assay work.—EDS. ELEC. REV.]

OBITUARY.

SIR FREDERICK BRAMWELL.

IT is with great regret that we have to record the death of Sir Frederick Joseph Bramwell, which took place in London on Monday last, the 30th ult. Some eight years ago Sir Frederick had a paralytic stroke, from which, however, he recovered most marvellously. The immediate cause of his death was cerebral hæmorrhage. Thus the second seizure was fatal, and the engineering world has suffered a loss which it could ill afford. Sir Frederick Bramwell was, in many respects, a unique figure in the annals of his great profession. Not only was this so in his personal appearance, which was most striking, but his peculiar bent of mind stamped him at once as being a man of more than ordinary pre-eminence. When it comes to be considered how marvellous were the times through which he lived—he was born a year before our late revered Queen—it is astonishing how intimately he was connected with all the various scientific and engineering discoveries of that age of progress. It is said that he greatly deplored his ignorance of all things scientific, and yet this must have been the modesty characteristic of the man, for those who knew him best were aware of the intimate knowledge he had of many subjects both inside and outside of his profession. The ease with which he acquired knowledge, and knowledge of an intricate nature, was supreme, and that which he once acquired he never lost. His memory in certain directions was of the most retentive and acute type. He could with ease fix a date to anything which had happened within his own experience. This faculty served him in most excellent stead. To the ordinary human being to have to refer back some 30 or 40 years and yet to have a distinct and accurate remembrance of any particular event must seem to involve a well nigh superhuman effort. Yet Sir Frederick has been known not only to place a particular happening in its own year, but even in its proper month. And this not once alone, but times and again. Perhaps this great gift of memory was the leading secret of his successful career. He could never forget a thing when he had once mastered it. It must be added also that having once encountered a subject, be it ever so involved, he mastered it.

It is well known that his elder brother, Baron Bramwell, after being a successful advocate, became a celebrated judge. Sir Frederick shared with him much of the judicial instinct. He was certainly the foremost arbitrator in engineering subjects of his day, and it must be admitted that his findings were impartial and met with universal approval. It is the sign of a great mind to acknowledge oneself in error if the occasion arises. This was a noteworthy characteristic of Sir Frederick. We have known him to listen with patience to the explanations of men much younger than himself, when some subject was in dispute, and readily to own if the

first instance he had been in error. Another attribute possessed by Sir Frederick Bramwell was the quickness with which he made up his mind. On those who knew him well this trait made a deep impression. He always knew what he wanted and could give in few words such instructions that no one had the least difficulty in producing the desired result. Lastly, but certainly not least, he was possessed of the most genial and kindly temperament. No one knew the full extent of his benevolence. There are many who will have only too great a cause to regret his loss.

In his time Sir Frederick filled many parts. He was a Londoner born and bred; few knew their native city better than he. His father was a banker; but Sir Frederick did not follow in his steps, preferring to carve out a career of his own. Of schooling he had but little, according to modern ideas, for he was apprenticed at the age of sixteen, and was worked very hard, as apprentices were in those days. There was but little theory then; it was all practice, and experience was hardly earned. But he was an engineer born, and to him all the work was a delight. It was not often, however, that he would mention the earlier years of his career, and when he did so the brief references would lead to the inference that the battle of life in the beginning was not any easier than with the rest of humanity. Indeed, there were times of something nearly approaching hardship, and it was not till long after middle life that Sir Frederick could be said to have approached the condition of being a wealthy man.

After his apprenticeship, he became head draughtsman in the shop where he served his time; then he was manager at a works in the Isle of Dogs, and finally, after one or two further changes, he commenced business on his own account in the year 1853. He was then 35 years of age. He had then been married five years to his cousin Leonora Frith. It was an uphill fight, his private practice, but after some five or six years the tide turned, and from that time onwards success was assured. Sir Frederick's professional life will always be remembered by two things, his success as a scientific witness and his eminence as an arbitrator. In either capacity he came into contact with nearly every scientific discovery of his lifetime. The scope of his practice was wide. He was chairman of an electric lighting company, chairman of a water company, and consulting engineer to a railway company. He was a recognised authority on all subjects relating to water supply. He was a designer of sewage schemes. He had much to do with telephones in the early stages of their existence. Many matters electric were frequently referred to him. His attainments were recognised in the form of honorary degrees by four Universities—Oxford, Cambridge, Durham, and McGill. He as early as 1873 received the much-coveted honour of being created a Fellow of the Royal Society. For 15 years he filled with marked ability the post of Honorary Secretary to the Royal Institution. He was a member of the Institution of Electrical Engineers, and had been a distinguished President of both the Institution of Civil Engineers and the Institution of Mechanical Engineers. He was intimately concerned, by reason of the position he held on the Council of the Society of Arts, of which he was at one time chairman, with all the great exhibitions of the last 25 years. In his capacity of member of the Court of the Goldsmiths' Company he was appointed to the governing Board of the City and Guilds of London Institute. He took the greatest possible interest in the Technical Institute, which the Goldsmiths' Company founded at New Cross, and among other things he completely designed the electrical equipment at this place. His own country house was electrically lit with an installation of his own designing, in which he took great interest. He was a member of the Court which inquired into the *Thunderer* explosion in 1879, and two years later was made one of the two lay members of the Ordnance Committee. He belonged to the British Association for nearly 40 years, and was President in 1888. His knighthood was conferred in 1881 and his baronetcy in 1889. It was not by any means only in engineering that his name was known and revered. He was, for instance, much concerned with the Patent Law Bill legislation in 1882. It would, however, take far too much space even to enumerate the many directions in which his great energy and ability found employment.

A busy, successful and long life came to an end in his eighty-sixth year. His loss will be regretted by a number beyond the ordinary, for his was a nature which endeared him to all with whom he came in contact.

The funeral is to be absolutely private, and will take place to-day at Hever, the parish in which Sir Frederick's country house is situated. The memorial service will also be held to-day at St. Margaret's Church.

LEGAL.

KNIGHT *v.* THE ISLE OF WIGHT ELECTRIC LIGHT AND POWER CO.

(*Continued from page* 859.)

EVIDENCE was given on both sides, and occupied the Court on Thursday, Friday, Saturday and part of Tuesday. The evidence being concluded,

Mr. YOUNGER, K.C., on behalf of the defendants, submitted that plaintiff had made out no case.

Mr. Justice JOYCE said that to his mind it was no use saying there was no nuisance.

Mr. YOUNGER said the defendants had never said that. What they said was that the nuisance was incidental to the starting of the engines, and was not of such a character as entitled the plaintiff to commence the action. They said there had been no nuisance since October 2nd, and that the nuisance to the plaintiff had at all times been exaggerated. The case put against the defendants was a continuing nuisance up to the date of the trial.

Mr. Justice JOYCE: A recovering nuisance—that there has been a continuous use of the dynamos.

Mr. YOUNGER said the nuisance had been shown by many witnesses to have been almost no nuisance. The plaintiff was not entitled to absolute quiet.

Mr Justice JOYCE said the case was a very serious one for the defendants—more serious to them than to the plaintiff.

Mr. YOUNGER said that undoubtedly was so. He did not know where the defendants would be if an injunction were granted.

The learned counsel then proceeded to deal with the evidence, his analysis of which occupied several hours. He quoted cases to show that an injunction could only be granted where a nuisance was continued and prolonged, and not where it was merely of a temporary character, and incidental to the completion of a building. He added that the writ in the action was actually issued before a single unit of electricity had been supplied to anyone but one customer for two hours, and the legal proceedings were commenced in the face of letters in which defendants stated that they were doing everything possible to get rid of the nuisance. The plaintiff gave the company no chance to get rid of the difficulties always incidental to works of this kind. The object of the plaintiff, he suggested, was to take advantage of what she believed was a nuisance at the time, so that the defendants might not have the opportunity of setting things right before the writ was issued. Under these circumstances he submitted that the action was absolutely premature.

(*To be continued.*)

BUSINESS NOTES.

Electrical Wares Exported.

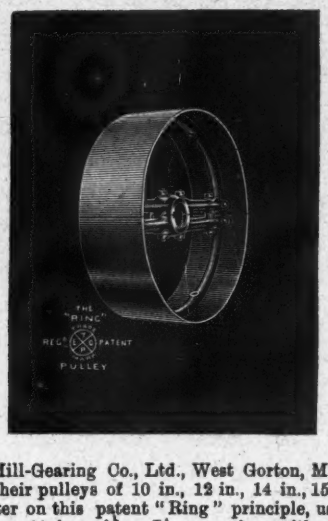
WEEK ENDING DEC. 2ND, 1902.		WEEK ENDING DEC. 1ST, 1903.	
Bangkok	Value £63	Alexandria	Value £22
Bombay	382	Amsterdam	54
Brussels	35	Antwerp. Elec. fuse	584
Buenos Ayres	2,004	Bombay	38
,, Teleg. mat.	100	Buenos Ayres	255
Calcutta	285	Calcutta	2,419
Cape Town	408	,, Teleg. mat.	201
Colombo	79	Canada (*via* States)	92
Durban	2,064	Cape Town	1,309
,, Teleg. mat.	1,342	Colombo	103
Flushing	10	Delagoa Bay	238
Hamburg	34	,, ,, Teleg. mat.	1,287
,, Teleg. mat.	76	Durban	848
Hong Kong	25	East London	147
Kure	168	Flushing	50
Le Treport. Teleg. mat.	200	Hamburg. Teleg. mat.	50
Melbourne	21	Hong Hong	73
Mossel Bay	12	,, ,, Teleg. mat.	95
Nagasaki	25	Madras	299
North Atlantic. Teleg. cable	20,400	Malta	17
Ostend	21	Melbourne	30
Perth	219	Monte Video	104
Port Elizabeth	65	Napier	33
Santiago	86	Perth	54
Singapore	206	Port Elizabeth	87
Sydney	887	Rio Janeiro	17
Wellington	405	Rotterdam	15
		Shanghai	200
		Singapore	89
		,, Teleg. mat.	89
		Stockholm. Teleg. wire	134
		Sydney	2,594
		,, Elec. cable	2,900
		Trinidad	25
Total	£29,522	Total	£14,502

Foreign Goods Transhipped.

New York.	Elec. apprts.	Value £102

For Sale.—At Manchester, on December 10th, Messrs. P. Huddleston & Co. will offer for sale by auction a variety of electrical apparatus, of which some particulars appear among our advertisements to-day.

The "Ring" Pulley.—The pulley we illustrate below has the boss, arms and inner ring cast in one piece. It is then split in halves, the irregularity of the fracture making a close and interlocking joint when the arms are bolted together. The boss is then bored and the ring turned on its face to afford a true surface on to which the wrought-iron rim is riveted. It is stated that the combination of the ring with the two arms and the close joint gives great strength combined with lightness, while the turned ring secures a true-running pulley. The makers—the "Unbreakable"



Pulley and Mill-Gearing Co., Ltd., West Gorton, Manchester—are building all their pulleys of 10 in., 12 in., 14 in., 15 in., 16 in. and 18 in. diameter on this patent "Ring" principle, using two rings for pulleys over 10 in. wide. In comparison with wood pulleys, a great advantage claimed for the "Ring" construction is the absence of the air-fanning caused by the wide arms of the wood pulley. The company's agents in most large towns stock this new type of pulley.

Milan Exhibition, 1905.—We have received a copy of the programme and regulations of the International Working Hall for Industrial Arts from the committee having this department of the Milan Exhibition under arrangement. British electrical and engineering firms who are disposed to take space for the exhibition—in operation—of their various manufactures and processes should communicate with the Secretary of the Committee, Piazza Paolo Ferrari, 4, Milan.

Catalogues and Lists.—A catalogue of electrical accessories for the present season has just been issued by Messrs. Sperryn & Co., Ltd., of Hospital Street works. It is a wholesale price list, and abounds in illustrations of lamps and holders, brackets, electroliers, pendants, bell pushes, switches and so on. The prices have been generally revised, and in some cases reduced.

Messrs. John Spencer, Ltd., of Wednesday, have issued the "22nd" edition of their catalogue of iron and steel tubes, including arc lamp-posts, trolley standards, central station steam piping, also steam, water and gas fittings.

The Linolite Co., of 47, Victoria Street, S.W., have sent us a leaflet giving particulars and prices of their "Linolite" fittings, in zinc, copper and aluminium.

From Mr. A. V. Young, of 37, Walbrook, E.C., we have received a pamphlet describing his apparatus for the purification of water by electricity. The process and apparatus are claimed to be very simple. The principle involved is the enforced passage of the impure liquid in close contact with a series of alternately positive and negative metallic electrodes, by which the impurities are attacked and dissociated from the pure liquid and immediately separated from it by gravitation. When applied to boiler plants, it is claimed that this purifier will (1) effectively purify and soften impure or hard water; (2) effectually prevent any scaling in boilers or tubes; (3) reduce coal consumption from 10 per cent. to 20 per cent.

A fully illustrated list of milling machines and milling cutters has been sent to us by the Hess Machine Co., of Philadelphia.

An advance copy of a new circular describing time-switch apparatus has been issued by Messrs. Vandam, Marsh & Co., Ltd., of Upper Priory, Birmingham. It is claimed that these switches may be relied upon for sure and regular action under all conditions within the limits of such a device. The operations are obtained by a simple mechanical means, set in motion by strong clockwork, and the switch mechanism is not such that it affects the ordinary time-keeping qualities of the clock; the working parts, outside the actual clock, are practically run by friction, so that they cannot be thrown out of gear in the operation of setting. Only one dial is employed to set and effect all actuations; the setting pointers are worked direct, without gearing; and it is stated that the instrument works automatically for a full week without attention, and by an attachment which can be applied in the larger types of switches, if desired, the operator setting the time pointers is ensured against omission to re-wind the clockwork. These time switches are claimed to save an enormous amount of labour and expense in current, &c. Reference is made to an example, where 26 of the firm's smallest switches were applied on a system of arc lighting; before their use it was necessary to employ two men to go over the whole area, covering about 17 miles of road each day, to switch "on" and then "off" the various circuits; after the adoption of the time switches, the services of these two men were practically altogether dispensed with, and this without taking into account the very considerable saving in current. By their use, street and other public lighting can be run off the ordinary supply distributing mains, entirely dispensing with the services of a lamplighter or switchman. All that is necessary is that the time switch shall be wound up once a week by the lamp cleaner on his ordinary rounds. Since producing their first simple form, Messrs. Vandam, Marsh & Co. have been called upon for very many adaptations of the time switch, so that they now have between 20 and 30 distinct types and varieties. The present catalogue contains illustrations and particulars of the types which have been more generally adopted. The list goes on to detail the mercury contact type, the metallic contact, meter (change-over), and variable-rate meter types.

Litholite.—Messrs. Hunt & Hess, of the Grove, Hackney, N.E., who are manufacturing "Litholite," recently submitted samples to the Westminster Electrical Testing Laboratory for testing, and we have received a copy of the report stating the results obtained in tests for insulation resistance and dielectric strength. On to each side of a disc 8½ in. diameter and 0·327 in. thick was pasted a disc of tinfoil of 4 in. diameter. A guard ring, also of tinfoil, was pasted round the edge of the disc to intercept leakage. The insulation resistance between the two discs was measured and found to be 67,000 megohms with a testing pressure of 1,500 volts. On disconnecting the guard ring, the same figure was obtained, showing that surface leakage is negligible under normal conditions. The sample was next immersed in salt water for 24 hours, and after wiping off the surface moisture, but not otherwise drying, it was tested again, and the result was 60,000 megohms with the guard ring connected, and 600 megohms with it disconnected. In this case the surface leakage was some 100 times the leakage through the material. The sample was then left standing in a free current of air for three hours to dry, but was not baked, and when tested again the result obtained was 67,000 megohms with the guard ring, and 60,000 without it. The surface leakage was thus about 10 per cent. of the leakage through the material. It is thus claimed that the material is practically non-absorptive of water, has a high specific resistivity which is well maintained after immersion in water; and although there is a certain amount of surface leakage when first removed from the water, yet this is soon stopped as the surface dries by natural means. The specific resistivity of the sample from the above figures works out to 6,550,000 megohms per centimetre cube at a temperature of 58° F., when subjected to a testing pressure of 1,500 volts. The dielectric strength was measured by applying an alternating pressure of 120 cycles per second between the two tinfoil discs. The sample broke down with a pressure of 36,000 volts, having withstood 35,000 for a period of five minutes previously.

Electric Pumps for Heysham Harbour.—The Midland Railway Co. has just ordered from Messrs. Merryweather and Sons, of London, two sets of electric "Hatfield" pumps, each of 42,000 gallons per hour capacity. These will be fixed at the new depôt at Heysham Harbour to supply the fire main system.

Books Received.—"Ornamental Turning," Vol. i., by J. H. Evans. London: Guilbert Pitman. 3s. 6d. net.

"The Story of the Atlantic Cable," by Charles Bright. London: George Newnes, Ltd. 1s.

"Traite Practique de Telecommunication Electrique," by Ed. Estaunié. Paris: Ch. Dunod. 1904. 20 fr.

"Kalender für Elektrochemiker sowie Technische Chemiker und Physiker for 1904." "Beilage zum Kalender fur Elektrochemiker for 1904," edited by Dr. A. Neuburger. Berlin: M. Krayn. Mk. 4.

"The Localisation of Faults in Electric Light and Power Mains," 2nd edition, by F. Charles Raphael. London: The *Electrician* Printing and Publishing Co., Ltd. 7s. 6d. net.

"Science Abstracts," sections A & B. November 25th. London: E. & F. N. Spon, Ltd. 1s. 6d. each net.

"Geometry for Technical Students," by E. H. Sprague. London: Crosby Lockwood & Son. 1s. net.

Trade Announcements.—On Saturday last the address of the Ore Concentration Syndicate, Ltd., the Metallurgical Engineering Co., Ltd., and of Elmore & Elmore was changed to Broad Street Place, London, E.C.

Mr. Frank Crawter, who has represented the Chloride Electrical Storage Co., Ltd., in London for the past seven years has been appointed manager of the sales department at Clifton Junction, Manchester. His place in London will be taken by Mr. E. W. T. Ward, late of the British Westinghouse Co.

Liquidation.—The Electric Installation Co., Ltd., is winding up voluntarily, with Mr. R. V. Critchley, of 6, St. James's Square, Manchester, as liquidator. Creditors should send the usual details to him by January 13th.

St. Louis.—Those of our readers who contemplate paying a visit to next year's great exposition at St. Louis will be interested in an illustrated handbook which has been prepared by Dr. C. M. Kurtz, assistant chief of the art department, and issued by the authorities. It is, as it claims to be, "a connected story of the exposition, its inception, plan and scope; a view of the various steps towards its realisation," containing photographs of the leading personages now engaged upon its organisation.

Technological Dictionary.—Messrs. Newnes regret the delay that has occurred in the issue of the first part of their Technological Dictionary, but owing to the numerous references and verifications which had to be made, the publishers are compelled to delay the publication of the first number until January. Particulars of the work have been given in our advertisement pages, but Messrs. Newnes will be pleased to send a complete prospectus on application.

Electricity in Gas Works.—The chairman and directors of the Sutton, Southcoates and Drypool Gas Co., accompanied by Mr. J. Holliday, their engineer, recently paid a visit to the La Villette gas works of the Paris Gas Co. They were shown the electric machines for charging and discharging the retorts, which are at work in the large retort houses, of which they made a careful and critical inspection. They then proceeded to Bruges to inspect the De Brouwer. On their return to England Mr. Holliday drew up his report, and, acting on his advice, the directors have placed an order with the Electric Turbine Co., Ltd., for a complete installation of the Paris machines, including also the necessary coal hoppers, coal conveyors, hot coke conveyors, all driven electrically. The Whessoe Foundry Co., Ltd., of Darlington, who are the sole manufacturers, have the work in hand for completion by May next.

Australia.—The Australian Customs authorities have just given a decision to the effect that electrical search lights are for purposes of import duty, to be classified as "Machinery and Appliances, n.e.i., Electrical," the duty being 12½ per cent. *ad valorem*.

Imports of Foreign Electrical Machinery.—The imports of foreign electrical machinery into this country during the past month amounted to £37,720, bringing the total for the ten months ending with October last, to £467,738.

Accumulator Factories.—The Home Office regulations respecting the arrangement of factories in which the manufacture of accumulators is carried on come into force on January 1st, 1904. Copies may be obtained from Messrs. Eyre & Spottiswoode.

Forthcoming Book.—Messrs. Whitaker & Co. will publish next week "Electric Traction: a Practical Handbook on the Application of Electricity as a Locomotive Power," by John H. Rider, chief electrical engineer to the London County Council tramways. This work will deal with the various systems of construction, and the apparatus, generating plant, &c., used in electric railways and tramways.

Bankruptcy Proceedings.—A receiving order has been made on debtor's own petition in the case of W. H. Hooley and J. W. Talbot (Hooley, Talbot & Co., electrical engineers and contractors, of Regent Street, Rugby). The first meeting and public examination are to take place at Coventry on December 7th. The Official Receiver (Mr. E. T. Peirson, Coventry) has issued a summary, which shows gross liabilities £339, of which £271 is expected to rank. The assets, after deducting preferential creditors' claims, are estimated to produce £107, leaving a deficiency of £164. In the separate estate of Hooley, the deficiency is given as £2 16s., and in that of Talbot £1 1s. 11d. Debtors give as the causes of failure "insufficient capital, delay of the Urban District Council in supplying electric light, and loss upon a contract owing to the action of one of our customers."

A receiving order has been made on a creditor's petition in *re* J. W. Storr, electrical engineer, Dudley.

The last day for receiving proofs for dividend payment in *re* J. P. Child, electrical engineer, Woolwich and Plumstead, is December 15th. Receiver, Mr. A. Mackintosh, 24, Railway Approach, S.E.

On Friday last a receiving order was made in Bradford County Court against Cecil Wray, electrical engineer, of Simes Street, Bradford.

Exhibition of Electrical Machinery.—A large number of gentlemen connected with collieries, shipyards and engineering establishments in the Northern Counties visited the works of Messrs. E. Scott & Mountain, Ltd., at Newcastle, on Saturday last, November 28th, to inspect some new electrical machinery which that firm has recently completed. The chief item of interest was an enclosed three-crank compound steam engine of 400 I.H.P. fitted with one high pressure cylinder, 16½ in. diameter, two low-pressure cylinders, each 18½ in. diameter, with a stroke of 10 in., this engine giving the H.P. stated above with a steam pressure of 100 lbs. per sq. in., when running at a speed of 350 revolutions per minute. This engine is fitted with the firm's latest system of forced lubrication, which consists of a valveless oil pump delivering oil to all bearings and working parts and is complete with powerful crankshaft governors and steam separator. The engine is direct coupled to one of the firm's three-phase alternators constructed to give an output of 250 KW. at a pressure of 500 volts per phase, with a frequency of 50 cycles per second, this generator being of the revolving magnet type, with stationary armature and direct coupled exciter. The whole plant is of massive construction, and weighs in all about 40 tons. The engine and generator mentioned above have been built to the order of Messrs. Bolckow, Vaughan & Co., Ltd., and will supply current to one of Messrs. Scott & Mountain's three-phase induction motors of 100 effective H.P., which is driven by ropes on to one of the same firm's three-throw horizontal ram pumps, fitted with gun-metal rams, each 10 in. diameter, with a stroke of 15 in., and delivering 500 gallons per minute against a vertical head of 400 ft., and for supplying current to one of the firm's three-phase induction motors of 100 effective H.P. which drives a 6 × 15 three-throw pump, delivering 250 gallons per minute against a head of 1,600 ft. This plant has been constructed to the order of Messrs. the Harton Coal Co., for their Bolden Colliery, near Sunderland. The same firm also had on view some other machinery, including one of their combined enclosed two-crank compound engines of 150 I.H.P. direct coupled to a four-pole continuous generator of 65 KW. capacity, which is being made to the order of the Northern Counties Electricity Supply Co., also other pumps, engines, generators and motors, both of the continuous and alternating current type.

ELECTRIC LIGHT AND POWER NOTES.

Ashford.—The Ashford and District Electric Supply Co. will shortly apply to the B. of T. for a prov. order to light the area.

Baden.—The works of the Electro-Metallurgical Co. at Courtepin, near Fribourg, has recently started taking a supply of energy from the Government power station at Fribourg. Three-phase alternating current is supplied at 16,000 volts and transformed down at the company's works.

Bantry.—The Town Commissioners have resolved to obtain information from engineers in regard to the lighting of the town by electricity.

Basingstoke.—The U.D.C. has favourably considered the report on the electric lighting of the town by Messrs. Baker, Lees & Co., and will apply for power to borrow £25,000 for E.L. purposes.

Boston.—The B. of T. has asked the U.D.C. whether it intends to carry out its prov. order for electric lighting. The Council has replied asking for a years' extension of time.

Bothwell.—The Uddingston District Electric Lighting Co. will apply to the B. of T. for powers to supply electrical energy in the district.

Bradford-on-Avon.—The U.D.C. will not oppose the application of the Western Electric Distribution Corporation for a prov. order for E.L, but protective clauses will be demanded.

Brixham.—The U.D.C. has engaged Mr. E. S. Saunders, of Bristol, to report on a scheme for lighting the town, at a fee of £50; but if the scheme is not proceeded with his fee will be £25.

Bucklow.—The R.D.C. has accepted the offer of Messrs. Meldrum Bros., Ltd., to light the road from Timperley Station and along the canal by electricity at 15s. per lamp, the Council providing the lamps and pillars.

Clitheroe.—The T.C. has decided to apply for a loan of £12,000 for E.L. purposes. Of this £2,350 is for buildings, £1,670 for boilers and accessories, £3,250 for generating plant, including two steam dynamos, £1,835 for feeders, mains, &c., £350 for engineers' fees, £180 for travelling crane, £625 for land, and £1,000 for contingencies.

Denbigh.—The Southern District Electricity Corporation has informed the T.C. that it proposes to apply for powers for the electric lighting of the district.

Derby.—On November 25th a L.G.B inquiry was held with reference to the application of the Corporation to borrow £33,400 for the extension of its electricity generating plant and mains, and the provision of generating plant for supplying power to the proposed electric tramways for the borough. Mr. T. P. Wilmshurst (the borough electrical engineer) in explaining the scheme in detail, said there was at present some 4,000 H.P. in the generating station, and about 100,000 8-C.P. lamps or their equivalent connected. It was proposed to add a 500-H.P. dynamo and a battery for traction, a 500-H.P.-dynamo and another battery for lighting and general purposes, and a 500-H.P. dynamo for reserve for either system. It has been decided to convert the present alternating system of lighting into the direct-current three-wire system at 500 volts, and application was being made accordingly. The tramway scheme had been approved and already commenced, so much so that some £2,000 of the required loan had already been spent. There was no opposition to the application.

Dundee.—The T.C. has been informed that to use the flow of water at Lintrathen for generating purposes would not be practicable, as it would interfere with the water supply of the town.

Dunfermline.—The National Electric Construction Co. has decided not to proceed with its prov. order for lighting powers for the city. The Town Council's threatened opposition is supposed to have led to the action of the company.

Durban.—It has been decided to light the three suction dredgers by electricity, to enable them to work at night, and contracts have been placed in Leeds for De Laval steam turbine sets.

Frome.—A L.G.B. inquiry has been held into the application of the U.D.C. to borrow £8,500 for the electric lighting of the district.

Gelligaer.—The R.D.C. has decided to make application to Messrs. Guest, Keen & Co., for terms for lighting the village by electricity from the firm's works.

Germany.—The establishment of a municipal electric lighting station in the town of Viersen has just been decided upon.

Glasgow.—The trustees of the Clyde Navigation have decided to light and equip the whole of their new dock at Clydebank, which is rapidly approaching completion, with electricity.

In consideration of the large expenditure involved, Mr. Walter Dixon, electrical expert, was asked to draw up a report on the subject, which confirmed the advisability of adopting electricity instead of hydraulic power. The trustees have approved of the recommendations, and have agreed that an electrical expert be appointed to advise, and be associated with the mechanical engineer of the trust in the carrying out of the work.

It was remitted to a sub-committee to consider and report on the question of the trustees themselves providing an electric installation or obtaining the current otherwise.

Dublin.—The new system of electric lighting from the Pigeon House Works is not giving satisfaction. A special meeting of the Lighting Committee of the Dublin Corporation was held this week for the purpose of considering the failure which has occurred in connection with the lighting of the public arc lamps in the streets of the city. It appears that 250 lamps have been fixed ready for the supply of energy, which, however, is not yet available.

Hamilton.—Messrs. Edmundson's Electricity Corporation has decided to reduce the price of energy for lighting, on the flat rate, to 4d. per unit, doing away with the m.d. system; and for power to 2d. per unit for the first and second hours, and 1d. after.

Inverness.—The T.C. has agreed to accept the terms of Edmundson's Electricity Corporation for the introduction of electricity into the town. The company has agreed to carry out the work within one year from its commencement, and the cost will be about £18,000. On certain conditions it will be within the option of the Corporation to purchase the undertaking. The Corporation under the scheme will receive £2,100, this sum having been expended by them in connection with the electric lighting order.

Italy.—Application has been made for a concession to put down a plant to utilise the water power of the River Dora Riparia, at S. Ambrogio, Turin, in the generation of electrical energy. It is estimated that about 850 H.P. is available.

Keynsham.—The Keynsham Electric Light and Power Co. intends to apply to the B. of T. for a prov. order to light the R.D. by electricity.

Kidderminster.—The local electricity supply company has reduced the price of energy to 4½d. per unit, as from the New Year.

Lees.—The U.D.C. has sent a deputation to the Electricity Committee of Oldham T.C. relative to the supply of electricity from Oldham. It was explained by the deputation that the U.D.C. had got a prov. order which it was desired should be transferred to the Corporation in a manner similar to that in which the Tramways Order had been transferred. The Town Clerk said that the only thing the Corporation could do was to supply Lees as a local authority in bulk at the Oldham boundary. Eventually a sub-committee was appointed to confer with the U.D.C.

Liverpool.—Mr. A. Bromley Holmes has submitted a report to the E.L. Committee of the Corporation, in which he estimates that the output of the supply stations for the year 1903 will exceed that of the preceding year by the following percentages:—For lighting, 20 per cent.; for power, 60 per cent.; for tramways, 5 per cent. The increase in the demand for the past four years, expressed in the equivalent number of 16-C.P. lamps, has been:—For the year 1900, 30,500 increase; for 1901, 31,500; for 1902, 39,900; and for 1903 (partly estimated), 40,000 increase. The connections to the supply mains for lighting and power (exclusive of tramways) at the commencement of the current year were equivalent to 221,000 16-C.P. incandescent lamps. Mr. Bromley Holmes states that it is necessary for the Committee to consider what extensions will be required to meet the demand for electrical energy for the years 1904-5. The capacity of the present generating plant is as follows:—Lister Drive station, 6,300 KW., D.C., and 2,100 KW., H.T.; Pumpfields station, 8,400 KW., D.C.; Highfield Street, 1,100 KW., D.C.; Paradise Street, 1,750 KW., D.C.; Charters Street (destructor), 400 KW., D.C.; Oldham Place, 1,500 KW., D.C.; Lark Lane, 500 KW., D.C.; Gateacre, 140 KW., D.C.; Smithdown Road (destructor), 200 KW., D.C., and 200 KW., H.T.; Cobb's Quarry (destructor), 350 KW., D.C.; Lavrock Bank (destructor), 400 KW., D.C., and 200 KW., H.T.; Fairclough Lane (sub-station), 800 KW., H.T.; Lodge Lane (sub-station), 200 KW., H.T.; Garston (destructor), 250 KW., D.C.

The stations at Pumpfields and Lister Drive supply energy for lighting and tramways at 230 and 500 volts respectively. The smaller stations supply for lighting at the same pressure. To deal with the out-lying districts, and to supplement the supply in the central districts where the exising stations are fully loaded, energy at 6,000 volts is supplied by the Lister Drive station. This is transformed down at the four sub-stations. No more steam plant can be installed in the existing power stations in the central districts. The suggested extensions for 1904 are as follows:—At Fairclough Lane, an addition to the building and 2,000 KW. transforming plant. At Oldham Place, an addition to the building and 2,000 KW. transforming plant. At Rice Lane, the construction of a sub-station to contain transforming plant of 800 KW. At Cobb's Quarry, 800 KW. transforming plant. At Smithdown Road, 400 KW. transforming plant. It will also be necessary to order boilers, engines, generators, and accessories for the second section of the Lister Drive station. Should the Corporation decide on tramway extensions in the Garston or Gateacre districts further generating plant will be necessary at these stations.

Leicestershire and Warwickshire.—The promoters of the Leicestershire and Warwickshire Electric Power Act have given notice of their intention to apply to Parliament for an extension of time in which to carry out the order.

London.—CITY.—The City Lands Committee has submitted a report to the Court of Common Council relative to the supply of energy for lighting buildings under its control, asking for authority to enter into an arrangement with the Charing Cross and Strand Electricity Supply Corporation for the supply of energy at 3d. per unit for lighting and 2½d. for power for five years. The matter has been referred back to give the City of London Electric Lighting Co. the opportunity of tendering.

It was stated that as a result of the Corporation deciding to obtain tenders from the Charing Cross Co. the price of energy had been reduced from 8d. to 3d. per unit. But it is further stated that the Charing Cross Co. has now withdrawn its offer.

MARYLEBONE.—The Electric Supply Committee of the B.C. has recommended that application be made to the courts for an extension of time for the payment of the £1,212,000 awarded by arbitration as the purchase price of the local property of the Metropolitan Electric Supply Co. To relieve the Council of its legal difficulties the town clerk is taking the necessary preliminary steps for the promotion of a Bill in the next Parliamentary Session.

ST. PANCRAS.—The B.C. has resolved to borrow, subject to the sanction of the L.C.C., £23,960 for electric lighting purposes.

HAMMERSMITH.—The E.L. Committee has decided to instal, at an estimated cost of £150, two steam pumps for use in connection with the feed-water heater. A trial is to be given at the new workmen's dwellings in Yeldham Road of sixpence-in-the-slot electric meters. 24 meters are to be ordered.

SHOREDITCH.—The B.C. has sanctioned the expenditure of £494, the estimated amount for mains extensions, &c., to meet the demand for a largely increased supply of energy (3,500 lamps of 8 C.P.) to the Britannia Theatre.

BERMONDSEY.—Permission has been received by the B.C. from the L.C.C. to lay mains through Southwark Park. The Baths Committee has agreed to take water from the artesian wells at the electricity works at 4d. per 1,000 gallons. A total of 21,660 8-C.P. lamps have been applied for by private consumers up to date, or including public lighting 24,512. This is 12,012 lamps in excess of the capacity of the present plant.

THE METROPOLITAN ASYLUMS BOARD has decided to light the Fountain Hospital by electricity, and to obtain the necessary energy from the Grove Hospital. The extension of plant to be provided at the latter for lighting the Fountain Hospital will be obtained from the makers of the plant at present installed.

Longford.—A Committee has been appointed by the town to report upon the possibility of laying down an electric lighting plant on the Shannon for the lighting of the town.

Maidstone.—The U.D.C. has received the sanction of the L.G.B. to the borrowing of £1,770 for the purposes of the electricity undertaking.

Melksham.—The U.D.C., which is applying for a prov. order for E.L., has engaged Mr. Enright to report upon a scheme for lighting the town.

Newbury.—The Urban Electric Supply Co. has acquired the Greenham Flour Mills, of Messrs. Hollands Bros., and will convert them into an electricity supply works. The Mills are situated on the banks of the River Kennet, and water-power will be used.

Newcastle (N.S.W.).—The City Council has resolved to extend its electric lighting plant by the addition of a boiler and accessories, turbine set, switchboard, &c.

Newport (Mon.).—We are informed that a new station for the distribution of electricity is to be erected immediately.

New York City.—Arising out of a dispute over methods of payment, the effort is being renewed to start a municipal lighting plant. The present price charged by the Edison Co. for arc lamps is $146 a year, against $17·50 per lamp for gas per annum.

Pollokshaws.—The T.C. has resolved to apply to the B. of T. for a prov. order for the lighting of its area by electricity. It was reported that a committee of the Council had had an interview with representatives of the burghs of Rutherglen and Milngavie, who are interested in the proposals of the Clyde Valley Electric Power Co., and as a result of the latter interview, a letter was read from the Clyde Valley Electric Power Co. containing certain proposals. A letter was also read from the town clerk of Glasgow to the effect that the Electricity Committee of the Corporation would be prepared to receive a deputation from Pollokshaws on the subject of supplying electricity to the burgh. A deputation was accordingly appointed.

Prestwich.—The Lancashire Asylums Board has decided to expend £6,000 on additions to the electric lighting plant at the asylum.

Richmond.—The Richmond Electric Lighting Co. has resolved to wire consumers' premises free of initial cost, on payment of a rental of four 4½d. per lamp per quarter, the occupier having the right to purchase the installation at any time. The company will also undertake to wire premises and supply fittings on the hire-purchase system.

Pontypridd.—The D.C. has decided to adopt a free wiring system.

St. Albans.—The T.C. has decided to apply to the B. of T. for an order enabling it to transfer its order for electric lighting to the St. Albans and District Electric Supply Co. The company will repay the Corporation's costs up to £400, and the Council will have the option of purchasing the undertaking at the end of 14 years and each successive seven years.

Salford.—A loan of £5,000 has been applied for by the T.C. to cover the cost of laying cables, &c., for supplying energy to the district included in the Prestwich E.L. order.

Strabane.—The U.D.C. recently obtained sanction for a loan of £13,000 from the L.G.B. for the erection of a gas plant, but in view of the Ulster Electric Power Co. seeking power to erect a generating station in the area, it has been resolved to consult an engineer as to the advisability of commencing the erection of its proposed gasworks.

Stone (Staffs.).—The U.D.C. has resolved not to consent to the application of the Southern District Electricity Corporation for a prov. order for electric lighting in the Council's area.

Sunbury.—The U.D.C. has decided to raise no objection to the application for a prov. order for E.L. by Edmundson's Corporation on condition that the compulsory area should be extended, that the Council shall have the option of the purchase of the undertaking at the end of seven years as a going concern, at the end of 14 years at cost price plus 15 per cent., at the end of 21 years at cost price plus 10 per cent., and at the end of 28 years at cost price; and that the company enter into an agreement to supply energy for public lighting at a fixed sum, less than the present cost of gas.

Tunbridge Wells.—The T.C. has received a communication from a gentleman stating that he and a few influential friends would be willing to purchase the electricity works, giving £10,000 profit beyond the cost already incurred by the Corporation. The cost of the works has been £80,000. Colonel Holland, the president of the Ratepayers' League—a body which took a prominent part in advocating the sale of the municipal telephones—favours the proposed disposal of the undertaking. The T.C. has yet to consider the offer.

Widnes.—A special meeting of the T.C. has been called for December 21st, to pass a resolution that application be made to the B. of T. for a prov. order for amending the Widnes electric lighting order, 1901. The amendment asks for an extension of time to complete the works, and, if granted, the order will probably be handed over to a company.

Wiltshire.—The C.C. has resolved to expend £5,000 on installing the electric light in the county asylum.

Wroxall.—The Isle of Wight Electric Light and Power Co. has decided to light the district, and it is proposed to adopt the overhead wire system, as the estimated revenue from the district will not warrant the laying down of cables.

Wycombe.—The T.C. has offered to light a new building estate with electricity if the owners will supply the columns, and to provide an arc lamp outside the Town Hall, and to light incandescent lamps in other parts of the town.

ELECTRIC TRACTION NOTES.

Beckenham.—The U.D.C. at its last meeting considered a recommendation from the Tramways Committee that the overhead system be adopted for the tramways. A motion, however, was carried asking the B.E.T. Co. upon what terms, if any, they would consent to the conduit system.

Chicago.—An elaborate system for handling the bulk of the goods traffic in the heart of this city is designed to be in operation by July next. Contracts have been awarded for 50 electric motors and 1,500 freight cars for use in the tunnels now under construction, and on which $5,000,000 have been already expended out of an estimated total cost of $20,000,000. The tunnels will be connected with 38 important freight yards, and as each car has a capacity of 6 tons, it is expected to handle about 100,000 tons a day. An extensive system of telephones is also being installed in connection with the tunnels, the whole work being done by the Telephone Construction Co., of which Mr. George W. Jackson is manager and engineer.

East Ham.—The Tramways Committee of the U.D.C. are to visit Hastings to inspect the motor double-decked omnibuses running there.

Glasgow.—The Sub-Committee recommend to the parent Committee of the tramways the purchase of a purifier for Pinkston power station, and the deputation from the Committee saw the Harris-Anderson water purifier in operation at the power station of the Newcastle Electric Supply Co., Ltd., Wallsend. It is to cost between £1,400 and £1,500, but the general manager of the tramways estimates that it will save not less than £500 a year, and remove the necessity for considering an additional water supply for Pinkston boilers. The parent Committee has continued consideration of the recommendation.

A red spot or band is to be placed on all electric and gas lamps at the tramway stopping places, so that these may be observed as clearly as possible after dark by intending passengers. Arrangements are also being made for fitting 100 cars with illuminated destination signs on the sides, similar to the signs on the ends of the cars.

The Tramways Committee have agreed to receive a deputation from the T.C. of Kirkintilloch on the question of extending the cars to that burgh.

The Committee received a deputation from the T.C. of Barrhead on the question of the proposed car extensions to that burgh.

Following upon a deputation of the Tramways Committee visiting England with regard to the covering of the upper decks of cars, a report has been drawn up on the subject. It stated that the question of car-top coverings in Glasgow was governed by the height of existing bridges. If a top covering similar to those in Liverpool were fitted on to Glasgow standard cars, the clear headway from rail to bridge with Glasgow's centre running trolley would require to be 16 ft. 11½ in., which admitted of a 6 ft. ceiling on the upper deck. Supposing the passengers could put up with a 5 ft. 8 in. ceiling they would still require a clear headway of 16 ft. 7½ in. Unfortunately, there were only two, or at most, three of the tramway routes in Glasgow in the operation of which the cars did not require to pass under bridges considerably less than 16 ft. 6 in. high. In all, 15 railway and canal bridges were too low to admit of top coverings on the cars. By way of experiment, the Tramways Committee have authorised the general manager to have one or two standard cars fitted with coverings of the most suitable design. These will be tried on the Paisley Road or Parkhead route.

Gourock.—The unsuitability of the lifeguards presently used on the electric cars of the Greenock and Port Glasgow Tramways Co. formed the subject of discussion at a meeting of the Gourock Town Council on 26th ult.

Kansas City.—This last important American stronghold of the cable-car system has capitulated in favour of electricity. Cable cars were at first particularly successful here on account of the severe local gradients, but municipal enterprise has gradually levelled these natural obstacles, and improved methods of electrical engineering now demonstrate that the use of electricity is far more economical. There are now in the city only 32 miles of cable tramways as compared with 215 miles of electrical lines constructed, or under construction. A great economy is to be effected by the completion of a central power house on the Missouri River, where alternating current will be generated, and stepped down by rotary transformers at sub-stations.

London.—London County Council.—At the meeting on Tuesday, the Highways Committee presented a report relating to the proposed reconstruction on the conduit system of 22¼ miles of line, of which particulars were given in this journal a short time ago, and which are at present leased to the North Metropolitan Tramways Co. The work of making trial holes was being proceeded with, but it was desirable to obtain the approval of the Board of Trade and the borough councils concerned in order that the contracts might be arranged as soon as the estimates were ready. It was decided to submit the plans for the sanction of the Board and the borough councils, and also to forward copies to the tramway company.

The Council postponed for a week the consideration of a report proposing the expenditure of £64,000 for the purpose of acquiring property adjoining the projected generating station for the tramways at Pimlico. It is not expected that the site will be actually required for about two years, but it is considered desirable to arrange for the purchase of the additional property at the present time.

Paddington.—A letter from the L.C.C. asking for consent to a tramway from the Marble Arch to Cricklewood, and a contribution of one-third the expense of the necessary street widenings, was before the B.C. on Tuesday. The Joint Committee which had considered the matter, recommended that dissent be expressed to any line in the Edgware Road. After a prolonged debate this recommendation was rejected, and a motion was carried to the effect that the B.C. would consider the scheme if the L.C.C. agreed to bear the whole of the cost of the street widenings.

At the South-Western Court on Tuesday, Mr. R. Moffat Ford applied for the adjournment of his summonses against the L.C.C., charging them with allowing their electric tramways to exceed the limit of twelve miles an hour. He said that it was the intention of the Highways Committee to submit a recommendation to the Council at their next sitting on the subject of the speed of their cars.

New York.—The congested street traffic in New York City is being gradually alleviated. The greatest stress of recent years has been at Brooklyn Bridge, and never a week passes but some untoward circumstance impedes the regular traffic for an hour or more at a time. Four new loops have just been made at the New York end of the bridge, so that the Brooklyn trolley cars can now be loaded and unloaded more expeditiously, the total capacity being now 35,000 passengers per hour, a calculation which does not include those conveyed by the elevated railroad to the remoter parts of Brooklyn. At present the regulations do not admit of more than 280 cars being operated upon the track per hour, a headway of 102 ft. being insisted upon, the surface cars coming over on the north side of the bridge and returning *viâ* the southern metals. The new Williamsburg Bridge, which, when completed, will have a greater carrying capacity than the Brooklyn Bridge, will be opened in a few days' time, but so far no arrangements have

been made for cars to cross it. Another improvement now being introduced is the utilisation of the police for the regulation of the traffic at busy crossings, in the manner so familiar to Londoners. Hitherto there has been no regulation of this kind except where car tracks cross each other, in which case it has been customary for the traction companies to employ a signalman.

Penarth.—A private company is applying to the B. of T. for powers to construct electric tramways in the town. The proposed lines will join the Cardiff system.

Plymouth.—The T.C. is seeking powers to construct four additional lines of electric tramways in the town.

Salford.—The T.C. has applied for a loan of £5,500 for cars, outer deck covers, &c.

Spain.—It is stated that an English company will shortly present a project to the Department of Public Works for the construction of an electric tramway between Alicante and the principal towns of the province.

TELEGRAPH AND TELEPHONE NOTES.

Glasgow Telephones.—Mr. Bennett's wish to retire from the dual position of general manager was considered by a sub-committee of the Telephone Committee last week, and it was agreed to recommend that Mr. Bennett be continued as general manager till the end of the present financial year, and thereafter as consulting engineer to the department, the vacancy of general manager to be filled by the promotion of Mr. John Macfee, the present assistant manager. Mr. John M'Callum, who at present is cashier of the department, is recommended for promotion to be assistant manager and cashier.

The Non-delivery of a Telegram.—Owing to the immunity with which the Postmaster-General, as a servant of the Crown, carries out the duty of receiving and transmitting telegraphic messages, cases never arise in this country in which he is charged with negligence in the performance of his duty. It is otherwise in the United States, where the right to send messages in this way is in the hands of private companies, which, in many States of the Union, can be sued for damages for loss and breach of contract. A writer in an American law paper—the *Central Law Journal*—in drawing attention to the American law upon this question, has recently shown that the interpretation put by the American Courts upon the term "consequential damages" involves the telegraph companies in very serious responsibilities. It appears that in the States a telegraph company is a common carrier of intelligence, and owes a general duty under the law, to both sender and "sender" to transmit and deliver messages accurately and within a reasonable time. Naturally a large proportion of its business consists in forwarding messages of a social character, of sickness, death, &c. Although there is a well-settled principle of the law that damages cannot be recovered for mental suffering and injury to the feelings alone, when no other species of damage is proved, yet in suits against telegraph companies the Courts have not, in all the States, strictly adhered to this rule, but have sometimes granted damages for injury to the feelings in cases where no other legal damages have been proved. In a case which was heard in North Carolina, the action was for failure to deliver a message; the complaint showed that the telegram was sent by the plaintiff's sister who was left in charge of his house, that its cost was prepaid out of the plaintiff's money, and that it was directed to his father, at whose house plaintiff was stopping, the message being:—"Tell Henry to come home. Lou is bad sick." The Court sustained the action, saying that the plaintiff was able to sue on either of two grounds—first, that the sender was his agent; or, second, that the message was for his use and benefit, and that he might recover damages for his mental anguish and suffering. In Kansas, however, there has been a direct decision that such damages are not recoverable. While we can scarcely wish that our own telegraph authorities should be burdened with as great a responsibility as this, it might work well for the public benefit to impose some liability upon them for gross negligence.

Northampton Telephones.—We are informed that a short time ago Mr. F. F. Bennett, of Manchester, was invited to attend before a committee of the Northampton Corporation; that body is now considering a scheme of telephony which Mr. Bennett submitted.

Spanish Telephones.—Work is about to be commenced on the establishment of telephonic communication between Bilbao and Santander. The facilities thus offered will be of great advantage to the iron ore industry.

Wireless Telegraphy.—During last week the first of a series of experiments in the working of the De Forest system of wireless telegraphy has been carried on with very successful results between Howth (near Dublin) and Holyhead. Messages were transmitted at the rate of from 30 to 35 words a minute from Howth to Holyhead, where representatives of the Post Office, War Office and Admiralty had assembled to witness the experiments. The electric power was generated by a small 2-H.P. petrol engine producing electricity at 500 volts pressure, which, by means of transformers, was raised to 20,000 volts.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Dominica-Martinique	May 5, 1903	
St. Lucia-Martinique	May 7, 1903	
Anjer-Kalianda	Aug. 2, 1902	
Cayenne-Pinheiro	Aug. 13, 1903	
St. Lucia-St. Vincent	Sept. 19, 1902	
Reissa-Issa (Yemen)-Camaran	Oct. 22, 1902	
Paramaribo-Cayenne	Feb. 26, 1903	
New York-Hayti	April 18, 1903	
Trinidad-Demerara No. 1	Aug. 27, 1901	
Tourane-Amoy	Nov. 10, 1903	
Lagos-Brass	Nov. 14, 1903	
Tenedos-Chio	Nov. 25, 1903	Nov. 29
Landlines.		
Indo-European	Nov. 26, 1903	Nov. 27

CONTRACTS OPEN AND CLOSED.

OPEN.

Bermondsey.—December 15th. Water-tube boilers, coal plant, piping. See "Official Notices" to-day.

Brighton.—December 7th. Six water-tube boilers, piping, tanks, and sundry other steam plant, for the Southwick power station. See "Official Notices" November 6th.

Crewe.—December 4th. Wiring the new municipal offices. See "Official Notices" November 20th.

Enniscorthy.—January 20th. Electric lighting and pumping plant (seven sections), for the Lunatic Asylum. See "Official Notices" to-day.

Erith.—December 21st. "Assisted" wiring work. See "Official Notices" to-day.

Great Western Railway.—December 7th. Water-tube boilers, engines, three-phase generators and auxiliary plant, for the Park Royal power station. See "Official Notices" November 6th.

Govan.—December 28th. Coal bunkers, conveyor, and electric capstan. See "Official Notices" to-day.

King's Norton and Northfield.—Cables for the tramways. See "Official Notices" November 27th.

L.C.C.—December 8th. Electric wiring of five sub-stations and three tramway car-sheds. See "Official Notices" November 13th.

L.C.C.—December 8th. Four 3,000-KW. three-phase generators, with exciters, for the Greenwich tramway power station. See "Official Notices" November 13th.

L.C.C.—January 19th, 1904. Six electrically-driven three-throw boiler feed pumps for Greenwich power station. See "Official Notices" November 20th.

N.E. Railway.—December 7th. Tenders for six months' supply of telegraph apparatus, wire, and stores, are wanted by the secretary of the company at York.

Pontypridd.—December 24th. Free wiring tenders; also tramcars. See "Official Notices" to-day.

Preston.—December 12th. Traction switchboard and accessories. See "Official Notices" November 13th.

Stockport.—December 10th. Distributing cable. See "Official Notices" to-day.

Stockton-on-Tees.—December 15th. Motor-hiring proposals. See "Official Notices." to-day.

Sydney (N.S.W.).—December 30th. Telegraph, telephone, and electric light material for the Deputy Postmaster-General of Sydney. See this column for November 6th.

Trimdon Grange (Durham).—December 7th. The owners of East Hetton, Trimdon, and Trimdon Grange Collieries, invite tenders for 12 months' supply of electric light fittings, &c. Particulars and conditions from the store-keeper, Trimdon Grange Colliery Co., Durham.

Walthamstow.—January 1st. Permanent way, gas plant, engines, dynamos, batteries, switchboard, cables, overhead equipment, &c., for 11 miles of line. See "Official Notices" to-day.

Warrington.—December 14th. A year's supply of earthenware ducts. See "Official Notices" to-day.

Wimbledon.—December 8th. Water-softening and storage plant. See "Official Notices" November 20th.

CLOSED.

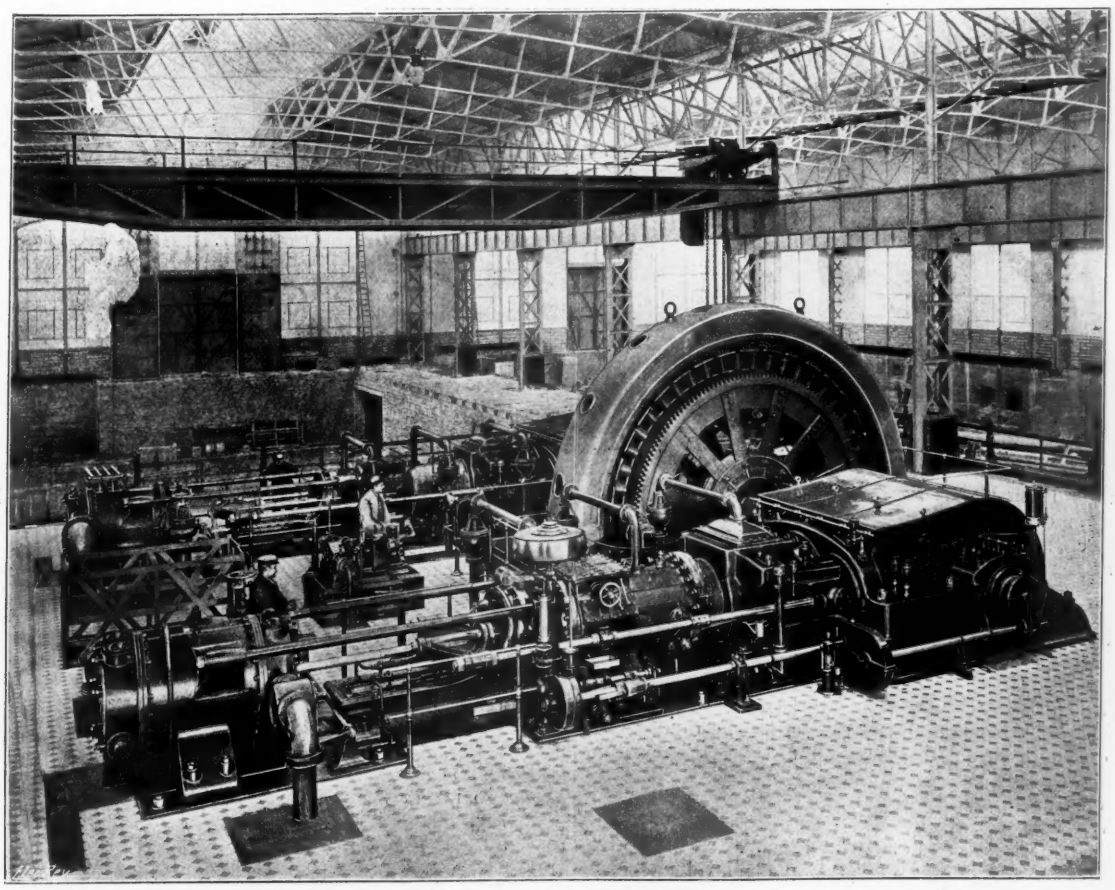
Blackpool.—The T.C. has accepted the tender of the British Westinghouse Co. for the supply of a 450-KW. traction set for the electricity works.

(*Continued on page* 912.)

BLAST FURNACE GAS POWER PLANT AT ILSEDER IRON WORKS (GERMANY).

The managers of the Ilseder Iron Works were early alive to the possibilities of economy to be derived from the use of gas engines fed with blast furnace gas. There are three furnaces at these works, which yield an average output of 220 tons of iron per day, and a fourth is being erected; the gas is of a very uniform quality, and is available in abundance. Coal of a quality suitable for steam raising is very dear at Ilseder, owing to the great distance of the works from the coal fields; but part of the furnace gases has been used under boilers to raise steam for supplying electrical generating plant of 1,830 H.P. There is a good demand for electrical energy in the works themselves and in the mines from which the supply of iron ore is obtained, and also for driving rolling mills at Peine, nearly four miles distant, where the iron produced at Ilseder is manufactured. The circumstances were, therefore, particularly favourable for the utilisation of the blast furnace gases for the generation of electrical energy; but before proceeding with this, two gas-driven blowing engines, of 500 H.P. each, were put down in place of the previously existing steam blowers, as the former use only one-fifth as much gas as the latter, leaving the remainder available for the electrical plant.

Ilseder Iron Works.



Ilseder Iron Works: General View of Engine Room.

The designs were prepared for a load of 6,000 H.P., with facilities for extension to 12,000 H.P. The engine room,

of which we give a view, consists of two bays, each provided with a 26-ton travelling crane, and measures over all 147 ft. × 214 ft., with a height of 56 ft. This room is intended to accommodate six generating sets, each rated at 1,000—1,200 H.P., one of which is shown in the view. The building is constructed mainly of ironwork, and is extremely well lighted.

The generating set consists of a three-phase alternator of the fly-wheel magnet type, driven direct by a pair of gas engines, one on each side.

The engines are of the two-cycle Oechelhaeuser type, each having two pistons working in one cylinder, and moving in opposite directions at the same time. These pistons are so arranged with regard to the positions of the admission and exhaust ports, which they uncover at the end of their outward stroke, that no other valves are necessary (see illustration on p. 409 of the current volume). A pump is driven by an extension of the piston-rod of the back piston, and forces the gas and air respectively into the admission ports at a pressure of a few pounds per sq. in.; compression takes place when the pistons approach one another on the inward stroke. Regulation of speed is effected by varying the quality of the mixture of gas and air.

The plant was installed by the German Power-Gas Co., of Berlin, a concern formed by the Siemens & Halske and the Union Electricity Companies to acquire the patent rights relating to the Oechelhaeuser engine. The combination is a curious one, seeing that since its formation Messrs. Siemens and Halske have joined hands with the Schuckert Co., while the Union Co. has thrown in its lot with the Allgemeine Elektricitäts Gesellschaft.

The alternator is driven at 125 r.p.m., and generates at 10,000 volts, 50 cycles per second. The irregularity factor at full load is 1 : 350, and the fly-wheel effect is 2,500 foot-tons. The fly-wheel shaft is connected with the two crank-shafts by couplings, so that either engine may be used to drive the alternator while the other is laid idle, if necessary.

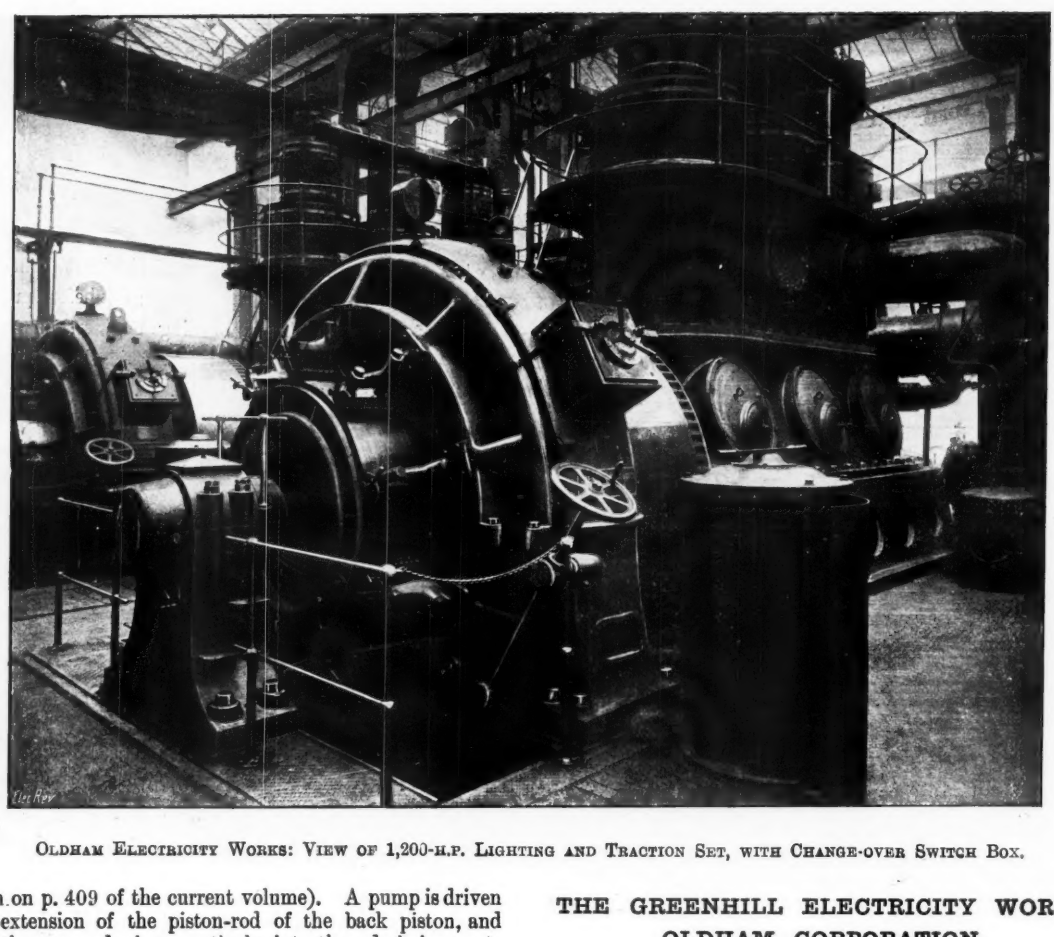
The alternator runs perfectly in parallel with the existing steam-driven generators, even when only one of the engines is used—a severe trial. The governors of the engine are electrically controlled from the switchboard, to facilitate paralleling.

The furnace gas is cleaned by two Theisen centrifugal washers, each of which is designed to free from dust 25,000 cb. ft. of gas per minute; the power absorbed is 110 H.P., and the water consumed is 440 lbs. per minute.

The main switchboard is mounted on a gallery, and is of the low-pressure type, containing only the measuring instruments, and the handles of the switches. All the high-pressure apparatus is securely housed in a locked room.

Most of the electrical energy generated is transmitted to the mines and the rolling mills; the latter are driven entirely by this means, even the rolling mills being coupled to electromotors, with entirely satisfactory results. There appears to be no task which the motor is not competent to perform.

The whole forms an excellent example of what might be done in many a British works, and we hope that it will not be much longer ere this *is* done. What are we waiting for?



Oldham Electricity Works: View of 1,200-h.p. Lighting and Traction Set, with Change-over Switch Box.

THE GREENHILL ELECTRICITY WORKS, OLDHAM CORPORATION.

(*Concluded from page* 867.)

The exhaust from each engine is led into a barometric condenser of suitable capacity, six of these having been supplied by Messrs. Babcock & Wilcox. They are placed in a small central bay, between the two main bays of the engine room.

Each engine has thus its own condenser, but the exhaust is also connected through an automatic valve, to one of the two main exhaust pipes, situated in the basement of each bay, and leading through the feed-water heaters to the atmospheric exhaust in the chimney.

The barometric condensers were made by Messrs. W. H. Allen & Son, and the condensing chambers are placed on stand pipes at about 30 ft. above the engine room floor level; the condensed steam and water are discharged down the stand pipe into a tank in the basement.

The injection water for the condensers is supplied by motor-driven centrifugal pumps, which, with the necessary switch-gears, are also of Messrs. Allen's make.

The larger sets are provided with L 8 size, Conqueror centrifugal pumps coupled to four-pole, 410-volt motors,

taking 30 amperes at a speed of 540 revolutions, and the smaller sets are L 6 size pumps, with 410-volt motors, taking 14 amperes at a speed of 675 revolutions per minute. The pump delivery pipes are carried up to the condensing chambers, into which they deliver tangentially.

The engine exhausts pass through oil separators of Messrs. Babcock & Wilcox make, which are situated above the central gallery between the two engine room bays, and

Oldham: Marine-type Dryback Boilers.

finally up into the pear-shaped condensing chambers at about roof level. Vapour discharge pipes from the tank in the basement are provided to carry off any air from the condenser discharge.

These condensers are considered to be more economical both in power and space, occupied than the ordinary jet or surface condenser. The arrangement of barometric condensers, oil separators, centrifugal pumps and switch-boxes is clearly shown in the illustrations.

The switch-boxes are clamped to the supporting pillars of the central gallery, and each contains a motor starter, shunt regulator, double-pole switch and fuses, and ammeter.

The condenser pumps take water from a 30-in. pipe leading from the storage tanks under the cooling towers, which are to be constructed at the end of the boiler house. The water from the condenser discharge tank returns through a similar, parallel pipe, leading to a pump house, where it will be pumped to the top of the cooling towers.

The pump house will be equipped with two motor-driven centrifugal pumps, capable of delivering 3,000 and 1,500 gallons of water per minute respectively to a height of 66 ft.

Two natural draught cooling towers, 90 ft. in height, will be erected. Each is specified to be capable of cooling 180,000 gallons per hour, 40°, under any atmospheric conditions.

The cooling towers, with all the necessary pipework, and three motor-driven centrifugal pumps, are being supplied by Messrs. Arthur Koppel, of London. All the pipework, valves, &c., in the engine and boiler house, the feed pumps and heaters, and the condensing plant has been supplied through Messrs. Babcock & Wilcox.

Two distinct 16-in. steam mains, run along the front of each row of dry-back boilers in either bay, and are connected through the main steam-pipes in the engine house. Two 12-in. steam mains, also run one on either side of the "Climax" boilers, and are connected with one alternate 16-in. steam main on either side of the boiler house. Separate steam connections are provided for the Weir pumps, one from either of the two steam mains. All the steam pipes are of mild steel, lap-welded, with heavy wrought-iron flanges.

Distinct branches to either steam main are provided on each boiler, and provided with both stop and non-return valves. All the exhaust pipes are of cast-iron, with the exception of the bends near the engines, which are of copper, with gun-metal flanges. All the valves for the steam and exhaust piping were supplied by Messrs. Hopkinson, of Huddersfield. The oil separators in the exhaust pipes are fitted with drains and collectors leading to a tank in the engine room basement. The oil will there be filtered and used again.

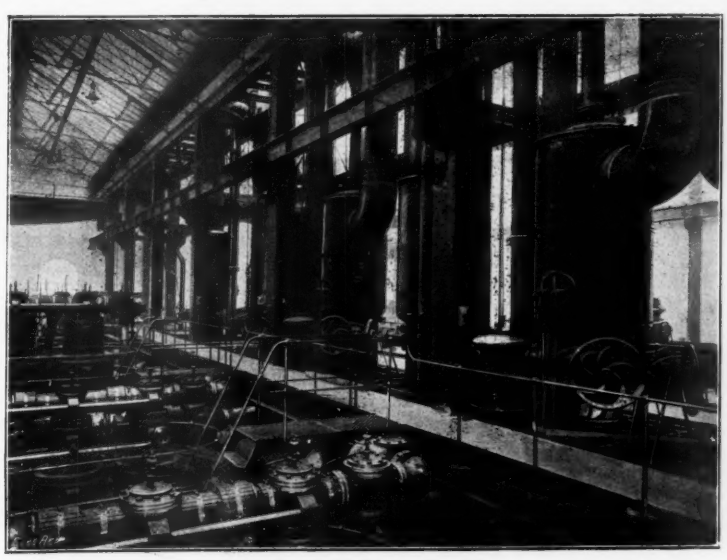
The switchgear is situated on the gallery previously mentioned, about 15 ft. above floor level, at the south end of the engine room.

Both lighting and traction boards are provided, and have been supplied by Messrs. S. H. Heywood, of Manchester. Each board consists of a front and back row of panels, those in front carrying the controlling switches and instruments, and those behind, the fuses, meters, &c.

The lighting board contains two feeder panels, on which provision is made for five positive and five negative feeders, each of 1,500 amperes capacity, and fitted with special knife switches and ammeters. On one of the feeder panels two pilot voltmeter switches are fitted.

Three machine panels are provided, one for each lighting set, and one arranged to couple either of the two larger generating sets in the traction bay to the lighting bus-bars. Each machine panel has mounted on it two 2,100-ampere E.C.C. circuit-breakers adjusted for maximum and minimum cut-out, one ammeter and plugs for connecting to a spare bus-bar.

There are also two station coupling panels for connecting this board with the existing lighting board at Rhodes Bank. Each of these is fitted with two 2,100-ampere knife switches with carbon breaks, an ammeter and plug, for the spare bus-bar.



Oldham: Barometric Condensers and Pipe Gallery.

The subsidiary board at the back, contains Chamberlain and Hookham ampere-hour meters and duplex plug fuses for each machine and station coupling panel, also three pilot fuseboards.

As previously mentioned, there are two sets of bus-bars, each having a section of 6 sq. in. Connections can be made to either set of bars, and they can be run at different pressures. No middle wire bus-bar is provided, owing to the balancing being done at Rhodes Bank.

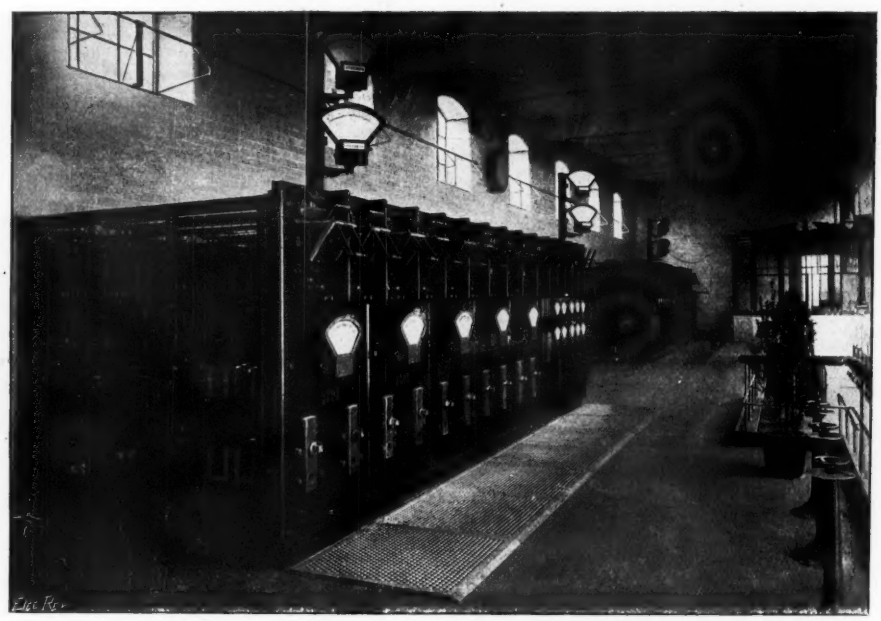
The connections between the main and sub-boards and to most of the fittings are of copper bar, painted so as to be clearly distinguishable.—Two pairs of voltmeters are fixed above the board; one pair is for comparing the dynamo and bus-bar voltages, and the other for indicating the positive and negative feeding point voltages.

The traction board also contains seven panels. Four generator panels, each fitted with 2 E.C.C. circuit-breakers, an ammeter in the positive and current indicator in the negative lead, voltmeter plug socket, &c.

One main coupling feeder return switch and testing panel, as required by the Board of Trade, fitted with a 6,000-ampere negative main disconnecting switch, a voltmeter plug socket for comparing the bus-bar voltages at Rhodes Bank and Greenhill, a centre zero ammeter, for indicating the direction of the current to or from Rhodes Bank, a maximum circuit-breaker coupling the two stations, one 6,000-ampere watt-hour meter in the positive bus-bar, one 6,000-ampere recording ammeter for registering the total return current in the negative bar, and a double scale leakage ammeter.

On the two remaining traction feeder panels, provision is made for six traction feeders, each of 1,500 amperes capacity, an I.T.E. circuit-breaker and ammeter being fitted in each case.

A pair of indicating voltmeters are fixed on a bracket above the board.



Greenhill Electricity Works, Oldham: View of Lighting and Traction Switchboards.

Fig. 1.

Fig. 2.

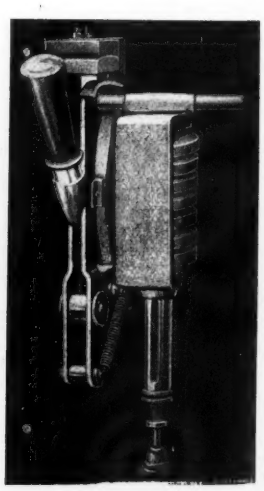
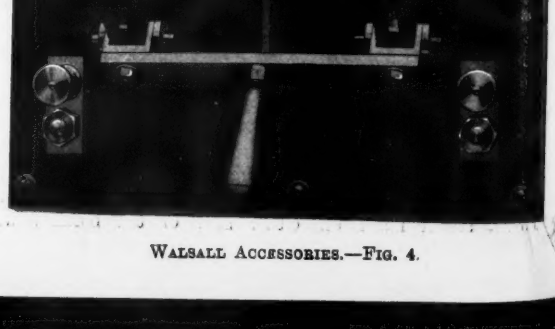


Fig. 3.

Walsall Accessories.



Walsall Accessories.—Fig. 4.

The subsidiary board contains B.T.H. watt-hour meters and duplex plug fuses in each machine circuit, two watt-hour meters (direct and reverse) in the station coupling feeder, and the lightning arresters in connection with the traction feeder circuits are also arranged behind the main board. These boards are substantially built and commendably simple in their arrangement.

The machines in the traction bay have field regulating switches mounted on their magnet frames, and the two larger machines, intended for either lighting or traction work, have change-over and equalising switches, fixed in a special pillar box at the side of the generator. One of our illustrations shows such a switch pillar open, the switch blades being fixed to a vertical spindle operated by the handle at the top; the panels on either side of the spindle are connected, one to the lighting and the other to the traction switchboard. Access to the cables at the back of the panels can be obtained through a door.

The location of the new electricity works at some distance from the original Rhodes Bank station has rendered necessary the provision of inter-connecting cables to that site, with a view to joining up to the original distributing network, which, of course, starts there.

Owing to the existence of a great width of railway between the two sites, it has been necessary to erect a special cable bridge. This is of the lattice girder type, and consists of five spans; it was built by Messrs. Cross & Cross, of Walsall. Provision is made for carrying 32 cables, which will be supported on porcelain insulators, and protected by corrugated iron casing. These cables are supported on steel supports in the basement of the station and laid for a short distance along Churchill Street on the solid system. Those which are taken across the railway will be carried through a tunnel where they will be supported on suitable hangers and porcelain insulators to the cable bridge; on leaving the bridge they are laid on the solid system to the Rhodes Bank station.

All the cables for this work have been supplied by Messrs. Glover & Co., Ltd., of Trafford Park, but the laying and connecting up has been carried out by the Corporation staff, under the supervision of Mr. S. Wilmott Newington, the borough electrical engineer, to whom, in conclusion, we beg to acknowledge our indebtedness for assistance kindly given in the preparation of this description. We are also indebted to Messrs. Kennedy & Jenkin for the general plan of the station, given in our last issue.

DEVICES AND FITTINGS FOR THE CURRENT ELECTRIC LIGHTING SEASON.

(*Concluded from page 774.*)

Walsall Accessories.

We illustrate on page 910 some new specialities and accessories recently placed on the market by the Walsall Electrical Co., Ltd., of 57, Bridge Street, Walsall, and described in their new catalogues. We understand that the company have a complete list in course of preparation, but to bridge over the time whilst this is being completed, they have issued several descriptive leaflets for their more important specialities. One of their chief lines of manufacture consists of main switches for all purposes, and fig. 4 represents one of their new main D.P. switches and fuses. We understand the design of these switches is the outcome of many years' experience and experimenting in pursuit of a switch both electrically and mechanically perfect, and they claim that it is a combination of great mechanical strength and simplicity of construction. The special feature of this switch is the adjusting screw placed between the laminated copper contact pieces, which is provided to compensate for wear, and to readily adjust the pressure on the contact studs. The lists state that these switches are made in all ranges from 12 to 200 amperes, both with and without fuses, single and double-pole. They may be mounted either in teak cases with lock and key or in cast-iron cases. As the switches are all made to template on special steel mounting plates, the Walsall Electrical Co. are doing a large business in unmounted switches for erecting on to switchboards direct, as by making them in quantities the price is naturally reduced. Another of the company's specialities is a voltmeter switch which they are making in great quantities, its chief feature being smooth working qualities with a high class finish. Another advance leaflet is devoted to a cheap type of voltmeter and ammeter for switchboard work, and we give an illustration (fig. 2) of one of the voltmeters.

Among the moving-coil instruments shown, for both portable and switchboard purposes, a speciality is an extremely handy combination testing set consisting of ammeter and voltmeter, of the moving-coil type, enclosed in a polished teak case. The ammeter is provided with two separate shunts contained within the case and has a double scale, thus giving an extremely open and variable range in the least possible space. Fig. 1 represents the "Walsall" portable moving coil ammeter.

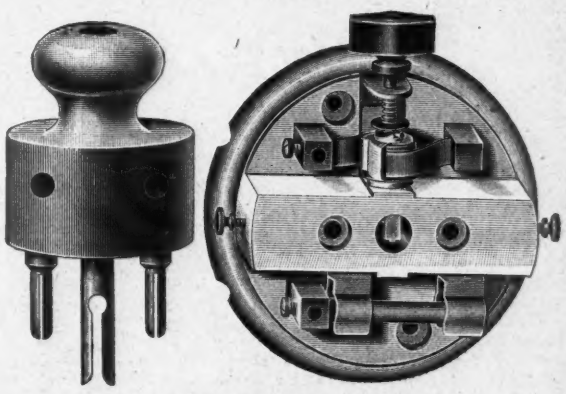
Another line to which the company have given great attention is automatic circuit breakers for both minimum and maximum currents or for reversal. Fig. 3 shows their S.P. type maximum current circuit breaker. The design of these is substantial and they are fitted with laminated copper contacts; they have an extremely long break which is not in any way interfered with by the mechanism employed to ensure quickness, such as a plunger spring placed between the contact studs. These circuit breakers can also be fitted with a special device making it impossible for the switch to be closed when there is a short-circuit on the line which it is controlling.

Amongst other switching devices are time switches for controlling town arc lamps, &c.; these we understand are already giving satisfaction in several boroughs. The company are also making a new speciality for automatically switching over from one meter to another at any desired time, the amount of current being used by a consumer from a supply company, this dividing the amount used into a day and night load, which are charged for accordingly, as Corporations and supply companies sometimes find this to be a more satisfactory method than the present very vexed question of maximum demand and rebate meters.

The company are making large central station switchboards for both traction and lighting purposes, a class of work in which we understand they are very busy at present.

Wall Plugs.

With reference to the Two-pin Wall Plug which is being supplied by Messrs. A. Vandam & Co., and was described in our issue of October 16th, page 617, the Bergmann Electrical Works, of Farringdon Avenue, E.C., write informing us that they have been making almost exactly similar plugs for several years, and have sold them



Bergmann Wall Plug.

in Great Britain and on the Continent, so that they are no new invention. The Bergmann Co., we understand, patented its switch in Germany, some three years ago (No. 125,766, of 1900), and our readers may for themselves compare the two devices by studying the accompanying illustrations of the Bergmann plug together with the illustration of the Vandam device already given.

The "Strut" Switch and Lampholder.

The General Contracts Co., Ltd., of 1, Fenchurch Avenue, E.C., and other London addresses, are supplying the patent "Strut" switch, which is a new departure in the construction of tumbler switches.

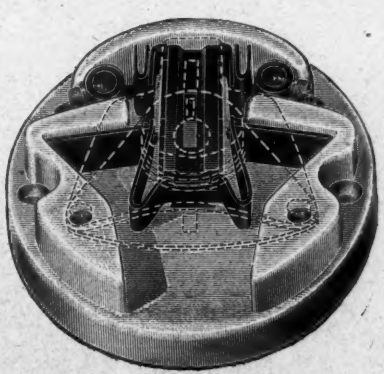


Fig. 1.—The "Strut" Switch.

It has been so devised that whilst working with the usual tumbler action, the make and break, which is of recognised length, is effected by means of a sliding centrepiece, to which is attached a flexible

metallic band engaging with movable struts placed on either side of the centrepiece, working in V-shaped recesses cut in the base. A rubbing contact is made by the combination being moved forward into laminated contacts, and the break is instantaneous and not within the control of the operator, owing to the stored propulsive power of the flexible metallic band. It is claimed that perfect insulation is secured by the construction of the base, and by covering the entire working surface of the switch with mica. The device is neat and compact, as none of the working parts protrude beyond the height of the base. Fig. 2 shows a section of the "Strut" lamp-holder, which possesses the good features outlined above, with the additional advantage of a tumbler movement for making and breaking contact.

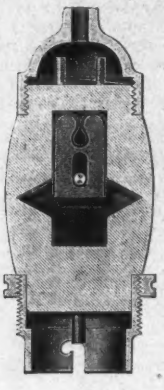
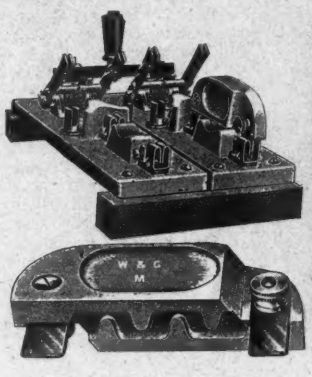
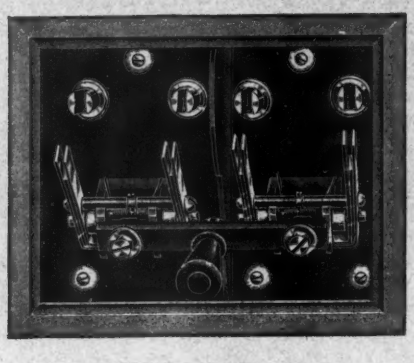


Fig. 2.—"Strut" Switch.



25-ampere D.P. Switch and China Replacement Fuse.



"Multum" Switch.

Messrs. Ward & Goldstone's Accessories.

Dining Table Lighting.

Messrs. D. H. Bonnella & Son, Ltd., of 58 & 60, Mortimer Street, Cavendish Square, W., are placing on the market a new arrangement for dining table lighting.

It consists of an undercloth which is placed under the ordinary white table cloth. This undercloth is formed by a lower cloth of baize, into which are sewn at regular intervals strips of metallic braiding, alternately connected at one end, the whole terminating in a length of flexible cord, which can be attached to a floor plug. Upon this undercloth is sewn an upper cloth (specially treated on the under side with a coating of india-rubber, which renders it waterproof), entirely enclosing the rows of metallic braiding. The colour of this upper cloth is "fast" so that should any liquid be upset the dye will not stain the table cloth. An ivory connector, with two sharp metallic points is attached to the fitting which it is desired to illuminate with flexible cord, it only being necessary to press the points through the white table cloth into the undercloth to make connection. A connector can also be attached to the underside of the fitting, permanently, if desired, doing away entirely with the use of flexible cord. The great advantage claimed for this arrangement is that it enables a light to be taken from any point on the table and that without any damage to the cloth.

Prism Globes.

The British Prism Globe Electrical Co., Ltd, of 145, Norfolk Street, Sheffield, have brought out a new fully illustrated catalogue of their Prism globes. They say that their globe has frequently been fixed without any regard to the claims made for it, which is unfortunate, seeing that the question of illuminative effect rests with the design and form of the lamp used within the globe, and the life of the globe largely depends upon the fixing. As the result of exhaustive experiments lately carried out, the company have obtained a lamp which they consider satisfactory when used with the Prism globe. They have therefore standardised their globe and lamp, and in future for street or outside fittings, no globe will be sold as a separate fitting, except for renewals in the case of breakages. A set of fittings will comprise the carrier, insulator ring, holder lamp and globe, and a very large stock has been prepared. The catalogue gives illustrations of a variety of arc and incandescent pillars, lamp-posts, cradles and carriers for incandescent lamp-posts, ornamental arms and brackets, tops for existing lamp pillars, &c.

Messrs. Ward & Goldstone's Switches.

Messrs. Ward & Goldstone, Dutton Street, Manchester, send us particulars of several of their specialties for this season which they are now manufacturing at their new works. One of the above illustrations shows their type B 25-ampere D.P. switch which is strongly and compactly put together; the finish is excellent and the metal parts are ample; it is mounted on enamelled slate and sells in polished teak case at a moderate price. It is also made with China replacement fuses, one of which we illustrate. Another specialty is the "Multum" switch, which is also type B pattern mounted on English porcelain with solid china walls between contacts, and is arranged for the No. 80 china replacement fuse carrier. This switch is well adapted for main currents, motor circuits, &c. The illustration shows one pole without the fuse carrier. Messrs. Ward and Goldstone also make a specialty of main switches in cast-iron cases, main fuses in cast-iron cases, and their well-known fuseboard with visible fuse wire in cast-iron or teak cases.

CONTRACTS CLOSED.

(*Continued from page* 906.)

Battersea.—The E.L. Committee recommends the acceptance of the offer of Messrs. Potter & Co. to provide the necessary pumping plant, including rising main, of mild steel tubes, having steel flanges welded on to the tubes, on foundations to be supplied by the Council, for the sum of £521.

Brighton.—The Corporation Tramways Committee has accepted the tender of Dick, Kerr & Co., for the supply of 10 tramcars at £5,100, and that of the Brush Co. for a similar number of cars at £5,085.

Gloucester.—The T.C. has accepted the following tenders:—

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., for converting a booster into a balancer, £160.
Callender's Cable Co., Ltd., for new distributing cable, £298, and cable laying for the tramways, £567.
Brush Electrical Engineering Co., 10 cars at £268 each.
Dick, Kerr & Co., Ltd., electrical equipment of 10 cars, £176 each.

Gravesend.—The British Westinghouse Co. has secured the contract for the supply of a 100-kw. steam dynamo for the Corporation. The set will consist of a Westinghouse generator driven by a Belliss & Morcom steam engine of standard pattern, running at 475 r.p.m. It will be shunt and compound-wound, and will give 460—550 volts according to the arrangement of the windings.

Ilford.—The U.D.C. has accepted the tender of Mr. R. H. Steele for installing the electric light in Loxford and Horne Schools, at £370.

London.—The City of London Electric Lighting Co. has recently placed with the British Westinghouse Co. an order for another 1,800-kw. direct current shunt-wound generator, to be mounted direct on the shaft of the driving engine. This machine will run at 75 r.p.m. and will be practically a duplicate of several other 1,800 kw. machines which the British Westinghouse Co. has has supplied to the same station.

Metropolitan Asylums Board.—On Saturday the M.A.B. received the following tenders for the installation of telephones at the Darenth Asylum:—

Dewhirst, P., 24, Birley Street, Blackpool (accepted)	£245 10
Mackrill, E. T., & Sons	247 13
Hodgson, Frederick, & Co.	257 18
Cox-Walkers	263 0
Private Wire & Telephone Installation Co., Ltd.	284 17
Defries, W.	289 0
New System Private Telephone Co., Ltd.	298 18
Western Electric Co.	3 9 4
Wippell Bros. & Row	340 0
Weston, G., & Sons	344 0
Sax, Julius, & Co., Ltd.	345 0
Ward Bros.	345 12
Rider, H. G., & Co.	349 0
British Home & Office Telephone Co.	364 0
Saunders, W. H., & Co.	369 0
Comyn, Ching & Co., Ltd.	374 0
Durant, B. & R.	413 13
Fuller, Macleod & Co., Ltd.	420 0
Jackson Bros.	440 0
Donnison, Sillem & Co.	459 0
Smith, Albert	566 0
National Telephone Co., Ltd.	620 0
Coleby, F. J., & Co.	750 0

The engineer's estimate was £240.

Middlesex.—On Thursday of last week the County Council placed an order for the construction of a light railway along the High Street, Harlesden, with Messrs. J. G. White & Co., Ltd., as an extra, on scheduled prices, but not to exceed £3,855 to their present contract for the construction of railway No. 5.

Paisley.—The Corporation has placed a contract for one 600-kw. traction and lighting generator with Messrs. Bruce Peebles & Co., Ltd.

Shoreditch.—The B.C. received the following tenders on Tuesday for the supply of 300 yds. 1-in. triple-concentric lead-covered cables:—

British Insulated & Helsby Cables, Ltd. (accepted)	£331
W. T. Glover & Co., Ltd.	345
Siemens Bros. & Co., Ltd.	370
W. T. Henley's Telegraph Works, Ltd.	377

Sunderland and District Tramways.—Messrs. Bruce Peebles & Co., Ltd., have secured the contract for the complete equipment of 1,000 H.P. for the power house; complete overhead equipment for 19 miles of track; 60 complete electric equipments for double-deck tram cars, as well as the cars. The value of the contract is £81,000.

FORTHCOMING EVENTS.

Saturday, December 5th.—At 7.30 p.m. Glasgow Technical College Scientific Society. Mr. W. H. Booth on "Superheat."

Tuesday, December 8th.—At 8 p.m. Faraday Society. Meeting at the I.E.E. Papers to be read:—

"Total and Free Energy of the Lead Accumulator," by R. A. Lehfeldt; "Bitumen in Insulating Compositions," I., by D. A. Sutherland; "Notes on Aluminium Welding," by S. Cowper-Coles; "Electro-Chemical Installation at the Borough Polytechnic Institute," by F. M. Perkin.

At 8 p.m. Institution of Electrical Engineers (Glasgow). "The Education of an Electrical Engineer," by Prof. F. G. Baily.

Wednesday, December 9th.—At 7 p.m. Institution of Electrical Engineers. Annual dinner at the Hotel Cecil.

At 7.30 p.m. Institution of Electrical Engineers (Birmingham). Meeting.

Thursday, December 10th.—At 5 p.m. Engineering Society, King's College. Prof. E. Wilson on "Aluminium."

At 2 p.m. I.E.E. Students to visit Brook Green Works of the Incandescent Lamp Co.

At 8 p.m. Association of Engineers-in-Charge. Paper by C. Wilson on "From Cotton-wool to Candle-power: the Evolution of an Electric Lamp."

At 8 p.m. Institution of Electrical Engineers. Gilbert Tercentenary Commemoration (see "Notes" to-day). Papers on "The Slow Registration of Rapid Phenomena by Strobographic Methods: the 'Ondographe' and 'Puissancegraphe,'" by E. Hospitalier; "On the Magnetic Dispersion in Induction Motors, and its Influence on the Design of these Machines," by Dr. H. Behn-Eschenburg.

Friday, December 11th.—At 8 p.m. Physical Society. Meeting. Papers: "The Simmance-Abady 'Flicker' Photometer," by Messrs. Simmance and Abady; "Exhibition of a Conductometer," by R. Appleyard.

Saturday, December 12th.—At 2 p.m. North of England Institute of Mining and Mechanical Engineers. Meeting.

At 7.30 p.m. Glasgow Technical College Scientific Society. "Steam Turbine Machinery," by A. A. Wynne.

NOTES.

A Preston Specification.—The specification for the switchboard required in connection with the new municipal tramways has just been issued. Though in accord with recognised practice on the question of an independent arbitrator in case of dispute, there are several directions in which some of the clauses of the general conditions might with advantage be modified. For instance, one paragraph gives the engineer power to vary the value of the contract without defining the limit beyond which the contractor has the right of revising his price. Another clause imposes a penalty of £50 per week in case of late completion instead of specifying a percentage of the total value of the contract, while a third makes the contractor liable for any errors or contradictions which may be present in the specification. We may be alone in our opinion, but we always feel that there is ground for nervousness when dealing with specifications having this stipulation, for we fear that the authors were not quite sure of themselves or their plans.

Rugby Engineering Society.—This society has been promoted by the staffs of the British Thomson-Houston Co. and of Messrs. Willans & Robinson, Ltd., but anyone interested in engineering is eligible for membership, and already there are some 350 members. The officers of the society for the Session 1903-4 are as follows:—

President, Mr. W. J. Larke; first vice-president, Mr. C. H. Wingfield; second vice-president, Mr. F. Samuelson; hon. recording secretary, Mr. E. R. Briggs; hon. corresponding secretary, Mr. C. C. Wharton; hon. treasurer, Mr. J. T. Irwin.

The first ordinary meeting was held on Tuesday evening, November 5th, when an interesting paper was read by Mr. F. Samuelson on the Curtis steam turbine, the paper being illustrated by a half-size sectional drawing of a 500-KW. turbo-generator, running in the B.T.H. power house at Rugby, as well as by curves, showing the steam consumption, &c. A meeting was to be held yesterday, December 3rd, when a paper was to be read by Mr. D. P. Thomson, member of council, on "The Central London Railway."

Committee Room Loafing at Westminster.—A correspondent writes:—"It has been stated with some truth that if one wants to interview a provincial town clerk, electrical engineer, or chairman of electrical committee, the easiest way is to lay wait for them outside the Committee Rooms of the House of Commons. Several people are beginning to have a suspicion that this constant running up to town and loafing about at Westminster is overdone, and is the cause of a great waste of public money and time.

"For example, suppose a company proposes to run a tramway between several small towns, or to supply power over a county, then all the clerks to councils scent a nice little job. The resulting visit to London is presumably in the interests of the ratepayers, but anybody who has seen what goes on during such visits knows that there is precious little which is to the interest of ratepayers or the community at large.

"The litigious expert business in House of Commons Committee Rooms reminds the writer of the schoolboy's remark, 'More cricket and less jaw,' when a certain bulky volume on our national game was published. There is certainly far too much jaw required to get any engineering proposition through its initial stages in this country. The only people who seem to benefit are lawyers and a few so-called experts. It is not so much a fiscal re-arrangement which this country wants as less jaw about law and vested interests.

"Expert evidence is very often nothing more than a farce, and to their discredit certain members of the profession are apparently prepared to give evidence for or against, just as they may be paid. In any case, what usually passes as expert evidence is very thin stuff indeed. Courses in elementary electrical engineering can be obtained at any Polytechnic for 10s. a session, but at the House of Commons it works out at about that price *per minute*. Lawyers' consultations are perhaps the greatest farce of all, the only apparent object being to help swell the fees.

"Occasionally, by making himself a nuisance, some town clerk may manage to get a special clause inserted by which the company are to pave a certain street or widen a road; it is, in fact, a species of blackmail paid for withdrawing his opposition. He no doubt obtains kudos for this clause when he returns to his native heath, but he omits to inform the ratepayers that whatever extra expense the company are put to will appear in the total cost price, which they will eventually have to pay when they buy out the company.

"The writer will not comment on the constitution of the committees, except to say that, judging by their questions and hungry-looking appearance, some of the M.P.'s are bright specimens; but, then, what can one expect from an assemblage three parts lawyers, and in which the percentage of engineers is rather less than 05?"

There is much truth underlying our dyspeptic correspondent's remarks, but a change of air might do him no harm.

Electrical Engineers Royal Engineers (Volunteers) N.C.O.'s Mess Dinner.—The non-com. officers of the Electrical Engineers R.E. (Volunteers) held their first mess dinner on Saturday, November 28th, at "The Clachan," High Holborn. There was an attendance of about 70, and among those present were Major Erskine, commanding; Capt. Dumble, adjutant; Capts. H. M. Leaf, O'Shaughnessy and Phillips; Lieuts. E. H. Leaf, Levin, Merritt and Russell-Clarke; and Surgeon Masters. The chair was taken by Sergt.-Major Shepherd, who, it may be mentioned, has just been offered, and has accepted, a commission. A large number of those present wore the South African medal, many of them with several bars, and some with the special service decoration and distinguished conduct medals.

After the dinner a capital programme was gone through, provided mainly by members of the regiment, and, needless to say, the songs partook largely of a military nature, "The Veteran's Song" and "The Deathless Army," by C. S. M. Leys, "Chorus, Gentlemen," and "The Yeomen of England," by Sergt. F. D. Arundel, calling for special praise. Versatility is a feature of electrical engineers, instanced by capital character sketches from Dickens by Corporal E. Buxton.

The toast list was commendably short. "The King," "The Officers," coupled with the name of Major Erskine, were briefly proposed and responded to; and "The Staff," in reply to which Capt. and Adjutant Dumble, following Major Erskine's lead, commented on the fact that but rare occasions existed for meetings of the staff as a whole. The difficulty was in getting the whole of the N.C.O.'s together to discuss matters relating to the welfare of the regiment. Capt. Dumble referred to the Eastern custom of commencing speeches and letters with compliments, thereafter proceeding to the actual business, and said he would adopt the later custom. He hoped that more opportunities would be made for the sergeants and N.C.O.'s to meet and discuss the question of promotions and the general good feeling between sergeants and the rank and file.

Sergt.-Major Shepherd then proposed "The Visitors," among whom were representatives from all the engineer corps in London and from the 3rd Middlesex Royal Garrison Artillery, to which Quartermaster-Sergt. Hammond suitably responded.

The last toast was "The Press," after which the meeting closed with the usual compliments. The whole proceedings were marked with a heartiness and a feeling of good comradeship which augurs well for the corps, it being a known fact in matters military that much depends on the N.C.O.'s working harmoniously together to secure that *esprit de corps* which can alone lead to success.

Royal Society.—At the annual meeting held on Monday M. Curie was presented with the Davy medal in recognition of his and Mme. Curie's researches connected with the discovery of radium. Sir Wm. Huggins delivered his presidential address.

A True Tale of a Magnetic Circuit.—We had worked all day amidst sweat and grime of our own making, for the engine room, as befits a Government tug, was a model of neatness with its perfectly kept twin main engines, each of 600 H.P., and at last the armature which we had laboriously rewound was in place, and my assistant and I were coupling up the brush rocker, and warming up the engines for a preparatory spin. A few anxious moments engaged in watching the commutator, voltmeter, and speed counter to ascertain if the new winding (unavoidably altered, for when some 8,000 miles from the source of supply one must use the best section at hand, and very often the old bars annealed, straightened and rewound with silk tape) is going to "pan out"; then putting new fuses into the search-light circuit, we proceed to the upper deck to try the full load. The great beam of dazzling white from the automatic feed arc taking 100 amperes streams out over the gleaming waters of the land-locked bay, rivalling the moon sailing overhead in the deep blue tropical skies, and we revel once more in the balmy air after the great heat and fatigue below. Is it not well worth it, the glow of satisfaction at another awkward "job" completed under difficulties?

"Well, old man," said a friend, chief engineer of a small ocean liner, whose dynamo had been one to receive recent attentions at our hands, and whose vessel lay alongside, "you look as if a wash would not hurt you. Come aboard." When seated in his cabin, and the others had duly nominated their respective poisons, thus the second engineer: "Did you have to hammer her?" "Hammer what?" I could see no protuberent point, to this joke, but the rest did, and when the laughter had subsided I got it. "Weel, ye ken," said the chief, "it's like this. Saundy here disna' see ony joke in it the noo, but we've been heving mony a laugh sin'. I didna' ken much aboot dinnamos mysel' at the time." (I translate.) "You see, we had shut down the main boilers in dock in Capetown, and were working off the donkey, as we had some small repairs to make in one of the furnaces, when first night, all of a sudden, out went the lights. Man, we ran her fast, and we ran her slow, we oiled her—what you call it—common tatur, and we cleaned her up all round with paraffin—a drop we had aboard against the old man's knowledge. Sandy here—he was fourth then—was that mad, as he was working in the fire-box, and said he must have the light, 'as he couldna breathe' with the oil lamp, and it was no dynamo as was going to flummox him; only, if I don't misremember, it was a shorter word he used." ("Ye munna mind him; he catches it like aff the sailor men.") "But, man, it did the lot of us. We turned her and cursed, and turned her again and sweated, but it was no go. I got them to hunt up her old governor belt, and we put it on just as she came from the makers." ("Man, I canna' stand sic' guv'nors, and I always tak' the belt aff.") We disconnected the reducing valve we used when on the main boilers, and I fetched down my galvanometer and dry battery, what that chap in Durban gave me, but he had never told me which way to join her up. Anyway, she did us, and spoilt my up town clothes all to bits, as I was just off when they called me first. So the second and third and I went up town, and left Sandy swearing. Boys, when I came down about eleven, there was the cluster over the gangway burning good as you please, and below was Sandy, chipping in the firebox, pleased as two men. 'Well,' says I, 'what was it?' Says he, 'That's telling. It took me a long time,' says he, 'and a power o' hard thinking.' Well, I could see it was the whusky he was after, so I thawed him out, and I says, 'Come on,' I says, 'out with it! for I'm going to get to the bottom of this.' When we got alongside of her, she was running grand. Says Sandy, 'After you chaps went, I had another go at her, and got that mad she would not give a glim that I just took that hammer and gave her a wipe, and dang me if the lamps didna all cam up that sudden I could barely get to the stop-valve to stay them bursting—the one over the dinnamo's gane. Maybe ye'll get anither oot yer locker; that's all,' says he. 'That all?' says I—and my whusky looking out on him. We had steam on the main boilers next day, waiting till the coaling was finished to go out; but when we stopped her down and changed over, she was at the old tricks again, and that Sandy—ye wouldna believe it—couldna tell us whit way he had hit her before! Me and him and the other two, we had a smack at her all over; and, as my luck would have it, I fetched a chunk of hardwood aff on her, polished like, what they winds the wire on. That riled me. 'Saundy,' I says, 'ye're a leear, and if yer blows me any more of yer fairy tales, for the puppose o' getting a sup o' whusky, I'll have it out your hide,' says I—'and now,' says I." We got a bit excited like, and my luck, as I said, being out, I goes and drops the big hammer slap on the common tatur. 'Great Scott!' says I, 'she's done now!' and I up and goes to the old man, and he says, 'Send to town for a man,' says he, 'and sharp, too, or we'll be having no lights the trip.'

"Well, he came, and he was at it till just before sailing time, and he lifted the magnets and cleaned round, and knocked up the piece in the common tatur my hammer had knocked in, and turned it up true, and he said as we'd broke her magnetic circuit by using too much oil and unscrewing what we shouldn't. He brought the account to me to sign, and when I took it to the old man, he says, 'You never told me you had broke nothing,' says he; 'what's the magnetic circuit, anyway?' 'My hammer fell on it accidental, sir,'" says I.

Fiscal Policy and Electric Traction.—The Tramways and Light Railways Association have issued invitations for December 11th to hear an address by Mr. Atherley-Jones, K.C., M.P., the President of the Association, on "Fiscal Policy in special relation to the Tramway and Light Railway Industry." Sir C. Rivers Wilson, G.C.M.G., the past President, will take the chair at 8 o'clock at the Society of Arts, John Street, Adelphi, and a discussion and vote will follow in which several gentlemen of eminence in engineering and commercial circles are expected to take part.

A Resistance Furnace for Heating Tubes.—Mons. A. Gunts has described in the *J. de Chimie Physique* (1903, I., 177) a simple modification of the Heraeus furnace for heating porcelain tubes and the like by means of an electric current. A tube of refractory earth several millimetres thick in the walls, 4 or 5 millimetres larger in internal diameter than the external diameter of the porcelain tube which is to be heated, and about 60 millimetres longer than the extent of the heating required, is given several coats of a paste made of magnesia and alumina. This paste may be either a mixture of equal molecules of the two oxides, or may contain 8 molecules of magnesia to 1 of alumina. It is allowed to dry in the air, when it will be found to adhere well and not to be liable to chip. The amount of platinum wire needed as a resistance piece is calculated, and from the length is deduced the number of spiral turns which will have to be put round the prepared tube. A spiral of the necessary form is then chased in the coating of the tube, cutting into the material to a depth of about half a millimetre. In this groove is laid the platinum wire, the two end turns being double and tied together. Next a sufficient number of coats of the same paste are applied to give a layer over the platinum 4 or 5 millimetres thick. A sheet of asbestos is wrapped round the whole, and a weak current is passed through the wire to dry the coating. Should it crack, the holes are stopped with some of the same material. Finally a jacket of asbestos sheet is applied on which are fixed connections with the hidden platinum wire. In making the paste some gelatinous alumina or a weak solution of aluminium acetate is employed as an agglutinant. In some respects a paste made of calcium aluminate is preferable. This is prepared by mixing together 1 part of strongly ignited alumina, 1 part of alumina obtained by an incomplete calcination of ammonium alum, and 1 part of calcium aluminate made by heating to redness equal weights of alumina and pure chalk. It is necessary to see that none of the ingredients contain an appreciable quantity of silica. The dimensions of the platinum wire needed to give a definite result may be calculated by the following equation:—

$$4{\cdot}4\ \mathrm{R}_0 \frac{l}{s} \times \mathrm{I} = \mathrm{E},$$

where E = the maximum voltage available, I = the amperage, s = the section of the wire, l = its length, and R_0 = the resistivity of 1 metre of platinum wire having a cross section of 1 square millimetre. This latter value should be ascertained, as the figures in the books refer to chemically pure platinum. The coils of the spiral should not be closer together than 5 millimetres, unless it is desired to heat the tube with special rapidity.

Royal Commission on London Locomotion.—The Commission sat at the Westminster Hotel on Thursday last week, when evidence was given by Mr. J. H. Brown, chairman of the Highways Committee of the Battersea Borough Council. Witness, amongst other matters, dealt with the continual breaking up of streets by water, lighting and other companies, and pointed out that in two years ending September 29th, 1903, there were 8,731 such openings in Battersea. They felt that there should be some legislation on the subject, but strongly insisted that each Borough Council should be the street authority in its particular district. His Council was in favour of the appointment of a tribunal to deal with the question of London traffic, on which, however, the Borough Councils, as well as the County Council, should be represented, and they were further of opinion that the exemption of tramways from the jurisdiction of the Tribunal would not only be unwise in itself but opposed to the very *raison d'être* of the Tribunal. He referred to the defective means of communication and the great congestion at Clapham Junction, morning and evening, and said his Council very strongly desired the following things:—(1) The electrification of existing tram lines; (2) the establishment of the proposed new tram line from "The Plough," Clapham, along Clapham Common, north side, to Wandsworth; (3) the establishment of a passenger steamboat service on the Thames; (4) the extension of the South London electric railway from Clapham to the neighbourhood of Battersea Rise; and (5) the extension of the cab radius.

Mr. H. G. Hills, town clerk of Wandsworth, was opposed to the County Council having control over the opening or reinstatement of trenches in streets by companies. His Council objected to the suggested abolition of the veto of the local authorities with respect to tramway schemes.

Headlight Dangers.—A correspondent writes:—"A protest may not be out of place against the excessively brilliant headlights used on many motor-cars. The death of Mr. Loewe, who was recently killed by being thrown out of his car, was shown to be due to a brilliant light either on his car or on another one. Dazed by the light a young lady was unable to see her way across the road, and the car was run into the kerbstone to avoid her. We believe this is the first time that the danger of the powerful headlight has been proved to attend the motorist as well as the innocent outside public, for though the girl was, we believe, hurt, her injury was slight, and the motorist was killed. It does not appear that the light was carried by the deceased's car, but that it was on the other car, or both may have had them. These bright lights should be strictly vetoed. They are not necessary at fair speeds on English roads, and are a very great danger to pedestrians, cyclists, cabs, and generally other road users, for a man may try to avoid the car, and drive blindly into anything; there is no sight possible for some time after looking into such a light as those now becoming so common. Evidently, for their own safety, motorists would be well advised to discard these dangerous appliances. The ordinary lamps quite sufficiently serve to indicate a coming vehicle. The brilliant headlight may by some be thought necessary for a car at

an unfair rate of speed, but those who know the conditions attaching to a fair use of the road will feel little surprise at this latest accident."

Heresy!—"Wherever you can apply a belt or rope do not attach a motor." This remarkable dictum is attributed to "a leading electrical engineer" by a Mr. E. Kenyson, who read a paper on "Transmission of Power by Ropes," before the Staffs. Iron and Steel Institute, last week. "The last-mentioned method (electrical transmission) might possess certain advantages where units of power are required to be distributed over wide areas, or even in the more compact factories where prolific water supplies might be pressed into service for the working of turbines. But under the ordinary conditions regulating our commercial undertakings this method could not be recommended on the ground of economy."

Again, "In the opinion of many engineers of repute who had given considerable attention to the subject, direct coupled plants, apart from floor space considerations in congested districts, proved far less economical in the long run than when the power was transmitted from engine to dynamo through some elastic medium. The chief reason assigned was that an overcharged dynamo might be converted into a motor *pro tem.*, reverse upon the engine, and not infrequently cause considerable damage to expensive machinery, whereas the less rigid medium acted as a buffer between the two and responded to the slightest variations and undulatory movements, thus warding off the blow that would otherwise be felt through the entire system. The electrical department annals of more than one large corporation were eloquent with denunciations against heavy repair bills, stoppages of tram circuits, and semi-darkness."

These utterances, taken together, cannot be confined to a mere condemnation of direct coupling, but without doubt extend to a condemnation of electric driving of any description. That is sufficiently futile to need no criticism. The enormous yearly progress of electric driving in every department of manufacture will not be stayed by one brake-horse power by the breath of obsessed people like Mr. Kenyson.

How very much behindhand in his knowledge of things as they exist Mr. Kenyson must be when he speaks of the delusion of direct coupling. It would puzzle him to cite any important instance of rope-driven generators being installed in the last five years at least. He seems to be unaware, also, of the great advantages of motors over any other drive for cranes and ventilating fans, which he mentions somewhat especially as being suited for rope-driving. From what we know of rope-driven cranes, we should say that few things require more attention and give less satisfaction.

Rope-driving, in its time, has played a very important part, and there are now, and will be for long, many situations in which it is the best method for transmitting power available. Electrical engineers recognise its value well, and remember that it afforded the means by which power was first transmitted over any distance, as well as the economy effected when electricity succeeded it.

That portion of the lecture dealing with ropes proves Mr. Kenyson an expert in his own subject, but the value of future lectures will be enhanced by the omission of odious comparisons on the lines of those above, until the lecturer's own acquaintance with modern practice has been broadened, or until his engineers of repute have attended a few more evening classes.

The American Mechanicals.—On Tuesday last, December 1st, a four days' convention of the American Society of Mechanical Engineers was opened in New York. President Dodge took as his topic "The Money Value of Technical Training." Among the papers down for reading were the following:—

Richards, Frank.—"Is Anything the Matter with Piece Work?"
Gantt, H. L.—"Modifying Systems of Management."
Barth, C. G.—"Slide Rules for the Machine Shop as a Part of the Taylor System of Management."
Sweet, John E.—"What are the New Machine Tools to be?"
Scheffler, F. A.—"Suggestions for Shop Construction."
Gregory, W. B.—"The Pitot Tube."
Perry, F. B.—"Method of Determining Rates and Prices for Electric Power."
Gillet, Louis A.—"Three and Four-Wire Multiple Voltage Systems."
Jacobus, D. S.—"Test of a Compound Engine using Superheated Steam."
Miller, E. F.—"The Pressure Temperature Curve of Sulphurous Anhydride (SO_2)."
Allen, Benj. T.—"Construction and Efficiency of a Fleming Four-Valve Engine."
Morgan, C. H.—"A Compact Gas Engine, Beam Type."

Extension of Works.—Messrs. Hodgson Wright and Wood, of North Parade Works, Halifax, will shortly be removing to larger and more commodious premises, which will enable them to turn out three or four times the amount of work they do at present. The new works will be equipped with an electric travelling crane, and new tools and machines for turning out economically and cheaply their dynamos and motors, which are being manufactured under the Fynn patents. We understand that the firm are the sole manufacturers under these patents at present. All of the machinery will be driven by electric motors, which will take their supply from the Corporation mains. Messrs. Hodgson Wright and Wood are also taking up the manufacture of a new single-phase motor, which they claim to be a great step in advance.

Marriage.—On Thursday last week the marriage took place in London of Mr. Israel Zangwill, the author, and Miss Edith Ayrton, daughter of Prof. W. E. Ayrton. A reception was afterwards held at the residence of Professor and Mrs. Ayrton in Norfolk Square, W., and among those present were Sir William and Lady Crookes, Sir John Isaac Thornycroft, Major-General C. E. Webber, C.B., Mr. and Mrs. J. K. Jerome, Mr. and Mrs. Hall Caine, Mr. and Mrs. Barry Pain, Mr. Pett-Ridge, and Prof. and Mrs. Armstrong.

Goods Traffic on Tramways.—At a recent meeting of the Newcastle Association of Students of the Institution of Civil Engineers, Mr. G. Harrison Sheffield, the new president, delivered an address dealing with problems of transportation by rail. Mr. Sheffield considered the possibilities of electric tramways as the light railways of the future, and said that it was probable that in several large centres the authorities would—following American practice—introduce goods traffic on an extensive scale. In large towns it would be possible for depôts to be arranged for short-distance traffic, and this would reduce cost of cartage, and save wear and tear of roads. If railways took a common-sense and business view, they would accept the inevitable, and encourage goods traffic on electric tramways by arranging sidings into their goods yards and warehouses, and allowing the tramway wagons to run alongside. The railways would eventually reap a substantial gain, for though they would have to relegate a great portion of their short-distance goods traffic to the tramways, the tramways in return would act as important feeders to the railways, and the railways would also be able to reduce their costly cartage departments. He added that there was no reason why the special tramway wagons which would have to be constructed for goods traffic, should not run upon the railways, thus enabling them to work colliery sidings and factories. An important point would be uniformity of tramway rolling-stock to permit of free interchange of traffic in adjacent tramway districts.

Sensational Science.—Under this heading "Physicist" addresses a letter to the *Daily Telegraph* of November 28th, in which he poured out his righteous indignation on the ridiculous statements in the more sensational and "yellow" daily papers with regard to radium. Undoubtedly the cult of radium on the part of the unsophisticated public has reached a perfectly absurd pitch. Not only does the artless reporter talk gliby of the transmutation of elements, with hopelessly inapplicable analogies, the extinction of matter, the collapse of the law of conservation of energy, and other matters about which he is not in the least qualified to speak; but the man in the street—or rather the woman—is actually buying spinthariscopes for Christmas presents to "scientific friends" (presumably of the *pseudo* type), and is cheerfully paying as much as she would give for a smart hat! Really, the pursuit of "science" is being carried a little too far.

Electric Power Stations.—This was the subject of a paper which was read before the Glasgow University Engineering Society by Mr. P. D. Ionides. Interesting contrasts were made between the Glasgow stations, which are the highest of their class, and turbine stations, such as are now being erected in London, and it was shown that the latter could be completed at a capital outlay of about half that required for the slow-speed engine system. In the course of the discussion which followed it was generally agreed that turbines represented the best modern practice.

The Heat of Formation of Copper-Aluminium Alloys.—Louguinine and Schukareff have published the results of an investigation into the above question. The method adopted was suggested by Berthelot, and consisted in dissolving the alloys by means of a solution of bromine in potassium bromide; it was, however, found not to be available for samples containing more than 50 per cent. of aluminium. The heat of formation of copper bromide, when dissolved in a Br—KBr solution, was first determined, and was found to be 39·484 calories. Thomsen's figure for copper bromide is 40·9, but the difference may be explained by the fact that his salt was dissolved in pure water. The heat of formation of aluminium bromide, per 1 gramme of aluminium, was next determined, and was found to be 7·489 calories; Berthelot's value being 7·655. By the aid of these data the various alloys of aluminium and copper were studied, with the following result, the figures in parentheses being those based on Berthelot's figure for aluminium bromide:—Cu_3Al, 123·5 (145·3); Cu_2Al, 137·9 (166·8); Cu_3Al_2, 71·0 (107·2); $CuAl$, 20·8 (73·2); Cu_2Al_3, 48·9 (116·3); and $CuAl_3$, 57·2 (15·7). It will be observed that the figures obtained by the present authors differ widely from those given by the use of Berthelot's value for aluminium bromide, but they vary similarly. The second alloy quoted, Cu_2Al, exhibits the highest heat of formation, and seems to be a well-defined compound rather than a solution of one metal in the other. Two other compounds were also prepared in a crystalline condition, viz., Cu_4Al_9 and $CuAl_3$, but their heats of formation could not be ascertained, as on treatment with the Br—KBr solvent much hydrogen was evolved.—*J. Chim. Phys.*, 1903, i., 9.

The Gilbert Tercentenary Commemoration.—Next Thursday, 10th inst., being the 300th Anniversary of the Death of William Gilbert, the Mayor and other representatives of the Borough of Colchester will attend officially at the meeting of the Institution of Electrical Engineers at the rooms of the I.C.E. to receive an Historical Picture (representing Dr. Gilbert in the act of showing his Electrical Experiments to Queen Elizabeth and her Court), which will then be presented by the Institution to the Borough, in which town Gilbert was born in 1544, and died in 1603.

City and Guilds.—The annual meeting of the City and Guilds of London Institute will be held at the Mansion House under the Lord Mayor's presidency on Monday, January 25th. Sir William White, F.R.S., President of the Institution of Civil Engineers, and formerly Chief Constructor of the Navy, will deliver the address, and the Lady Mayoress (Miss Ritchie) will distribute the prizes to the students.

Supply Companies and Electric Railways.—A letter appeared in the *Times* the other day from the managing director of the London Electric Supply Corporation regarding electric railway traction, in which he says.—"In about a month's time this corporation will be supplying electrical power on a large scale for traction purposes. . . . The Deptford power station of this corporation, one of the largest electric generating stations in the country, is situated in close proximity to three of the southern railways, and from that station it would be possible to obtain a supply of electric power to work the suburban traffic of any or all of these railways at a price less (owing to the variety and extent of the load at the station) than it could be produced for by these companies, separately or jointly. The saving effected in capital expenditure to these railway companies from such an arrangement is obvious."

French Competition for Electric Motor Vehicles.—Owing to lack of entries the competition of electrical motor vehicles, referred to in our last issue, had to be postponed.

The Decimal System.—We learn that early next session a Bill for the compulsory adoption of the metric weights and measures throughout the United Kingdom, is to be introduced into the House of Lords. The first reading of the Bill will be moved by Lord Belhaven and seconded by Lord Kelvin, and we are informed that such an encouraging amount of sympathy with this measure has been expressed privately by other peers, that there are good grounds for expecting that the second reading of the Bill will be passed. The Decimal Association is appealing for subscriptions toward its campaign fund.

Will.—A financial contemporary says that Mr. John Dale, a director of the Scarborough Electric Supply Co., Ltd., who died on the 30th ult., has left property of the total value of £67,201.

Brush Electrical Engineering Co., Ltd. — The following is a list of the directors of this company:—Right Hon. Lord Vaux of Harrowden, Harrowden Hall, Wellingborough; Clarence S. B. Hilton, 41, Roland Gardens, S.W., gentleman; Wm. L. Madgen, 128, Upper Tulse Hill, S.E., engineer; George F. M. Cornwallis-West, 35A, Great Cumberland Place, W., gentleman; the following gentlemen having all resigned on September 30th, 1903: Charles E. Hodgkin, Purley Lodge, Reading, engineer; John S. Raworth, 46, Christchurch Road, Streatham Hill, S.W., engineer; Robert P. Sellon, Albury Edge, Mersham, Surrey, electrical engineer.

Electrolytic Deposition of Zinc on Iron.—According to O. Gabran, the best electrolyte for this purpose contains 1,200 grammes of zinc sulphate and 60 grammes of sulphuric acid (24° Bé) per 6 litres of water. In large baths a voltage of 9 to 10 should be employed, and a current density of 6 amperes per square decimetre. The author has designed an apparatus for the regalvanisation of the plates of iron ships, which is made so that it can be moved about over the hull. It is fitted with a rubber lip, in order that it may be pressed into contact with the plate, and arrangements are also provided for keeping the electrolyte in circulation. The apparatus takes 65 amperes of current, and is said to give a film of sufficient thickness in 7 seconds. The machine is specially suited for the purpose of applying a coating of zinc to the heads of the rivets, which have hitherto usually been left bare.—*Elektrotechn. Ziets.*, 1903, xxiv., 937.

Electricity and Trees.—Experiments have been carried out lately by Mr. Stone, at the Massachusetts Agricultural College upon the effect on trees growing at the sides of the road of the overhead electrical currents used in operating tramways, &c. Harm may be done to the trees, either by the formation of an arc caused by short-circuiting, or by the currents that leak to earth through the insulators. In this respect it appears that only direct currents are harmful, especially when the positive pole is connected with the rails. The electrical resistance of living trees is fairly high, but it differs in the different concentric portions of the trunks. The resistivity of the outer bark of the elm is 192,000 ohms, that of the maple 29,000. The resistivity of the inner elm bark is 11,300 ohms, and of that of the maple 18,000. The cambium of each tree presents a resistivity of 10,698 and 138,000 ohms respectively; while that of elm wood is 98,700. The measurements were made in the month of July.

Personal.—Mr. A. M. Dayson, assistant manager and engineer of the Sunderland Corporation electric tramways, has been appointed by the Tramways Committee to succeed Mr. Harry England as tramways manager.

The staff of the Portsmouth Municipal Telephone Department has presented a gold albert and a framed photograph of the Town Hall, to Mr. T. Holme, the manager, on his departure to Hull, where he is to undertake the management of the municipal telephones.

Alderman Martin Taylor has been elected chairman of the Tramways Committee of the Croydon County Council in the room of Councillor Rigby, who has retired from the Council. Councillor Stapleton has been appointed vice-chairman. The Lighting and Electricity Committee has re-elected Alderman Miller as chairman and Councillor Rogers as vice-chairman.

An unfortunate imprint on the title page of "Old Cape Colony" (Constable & Co.) attributes this book to Mrs. A. F. Trotter, instead of to Mrs. A. P. Trotter, by whom it was written and illustrated.

The Eastern Telegraph Co., Ltd., and the Eastern and South African Telegraph Co., Ltd., announce that Mr. George Draper, who has been secretary of the two companies since their formation, retires from office with a pension on December 1st next. Mr. A. R. Hardie, formerly the accountant, has been appointed secretary.

Scientific Soothing.—Colonel Gouraud, whose name needs no introduction to readers of this journal, is now "Acting Governor to Jacques I., Emperor of the Sahara." In an interview which a *Manchester Guardian* representative has had with him, the gallant Colonel outlined a scientific plan of charming the people into peaceful and civilised ways, the principal weapons being phonographs, gramaphones, typewriters and motor-cars, and no doubt other musical instruments. These are all classed as instruments of civilisation, which are thought likely to fascinate the subjects of Jacques. There will be nothing so antiquated as the railway allowed in this great development programme, indeed, the automobile will have things all its own way, for an automobile road 150 ft. wide is to be made right through the country from sea to sea.

Appointments Vacant.—Works superintendent (£200), shift engineer (£117), and sub-station foreman (45s.), for Dublin electricity works; shift engineer for Swansea electricity works (35s.); shift engineer for Tunbridge Wells (£100); shift engineer for Fulham (£104).

THE CENTRAL STATION ENGINEER.

Exeter T.C. has increased the salary of Mr. Munro, electrical engineer, to £350 a year, and has granted him an honorarium of £105 for extra work in connection with the new power station.

The Newcastle-on-Tyne Corporation Tramways Committee, on November 26th, decided to increase the salary of Mr. Le Rossignol, general tramways manager, from £750 a year to £850, rising by £50 per annum to £1,000; that of Mr. Fleming, car-sheds manager, from £200 to £250, rising by £25 a year to £300; and that of Mr. Easten, chief clerk, from £130 to £175.

NEW COMPANIES REGISTERED.

Priestman Power Co., Ltd. (79,256).—This company was registered on November 26th, with a capital of £40,000 in £1 shares, to erect a generating station at Blaydon, Durham, for utilising the gases and waste heat to be produced by ovens to be built by the owners of the Priestman Collieries, Blaydon, and for generating electric energy for distribution and sale to the Newcastle-upon-Tyne Electric Supply Co., Ltd., and the said owners of the Priestman Collieries and others, and to carry on the business of suppliers of electrical energy in all its branches. The first subscribers (each with one share) are:—F. Priestman, 2, Princes Buildings, Newcastle-on-Tyne, colliery owner; H. B. Noble, The Manor House, Newcastle-on-Tyne, barrister; J. T. Merz, The Quarries, Newcastle-on-Tyne, gentleman; H. Pelle, 2, Princes Buildings, Newcastle-on-Tyne, colliery owner; S. J. Leybourne, Birchholme, Gateshead, general manager; J. H. Armstrong, St. Nicholas Chambers, Newcastle-on-Tyne, chartered accountant; and R. S. Watson, 141, Pilgrim Street, Newcastle-on-Tyne, solicitor. No initial public issue. The number of directors is to be six; the first are F. Priestman, J. H. B. Noble, J. T. Merz, H. Pelle, S. J. Leybourne, and J. H. Armstrong; remuneration as fixed by the company. Registered office: 2, Princes Buildings, Newcastle-on-Tyne.

Kingswood Electric Supply Co., Ltd. (79,253).—This company was registered on November 26th, with a capital of £1,000 in £1 shares, to adopt an agreement with the Bristol Trust, Ltd., and to carry on the business of suppliers of electric light, heat, motive power, or otherwise, electrical engineers, contractors and manufacturers, electricians, mechanical and chemical engineers, &c. The first subscribers (each with one share) are:—S. Williams, Bristol, solicitor; W. E. Laurence, Bristol, clerk; H. Taylor, 28, Brighton Street, Bristol, accountant; J. Muse, 28, Exeter Street, Bristol, clerk; E. Watts, Bristol, solicitor; W. L. Bate, Carlton Chambers, Bristol, accountant; and H. V. Harvey, 27, St. Paul's Road, Clifton, barrister. No initial public issue. The number of directors is not to be less than two nor more than seven; the first are not named; qualification, 100 shares; remuneration as fixed by the company. Registered office, 46, Newman Street, Oxford Street, London.

Derby Electrical Co., Ltd. (79,228).—This company was registered on November 24th, with a capital of £1,000 in £1 shares, to acquire the business of an electrical engineer carried on by J. Hill at Wood's Lane, Derby, and to carry on the same and the business of manufacturers of and dealers in motors, dynamos, lamps, wire cables, insulating materials, accumulators, telephones, electrical instruments, apparatus, and machinery, &c. The first subscribers are:—J. Hill, The Hollies, Empress Road, Derby, engineer, 927 shares; W. Shardlow, 19, Bakewell Street, Derby, engineer's manager, 10 shares; H. J. Furniss, Camden Street, Derby, electrical engineer, 10 shares; J. P. Jones, Rowena Villa, Shepherd Street, Littleover, Derby, clerk, 1 share; Mrs. E. Hill, The Hollies, Empress Road, Derby, 10 shares; G. F. Beach, 179, Barton Road, Derby, clerk, 1 share; and F. H. Rainsford, Parkside, Mill Hill, Derby, outfitter, 1 share. No initial public issue. The first directors are J. Hill, W. Shardlow, and H. J. Furniss; qualification, £5. Registered office: St. George's Engineering Works, Wood's Lane, Derby.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Kent Electric Power Syndicate, Ltd. (72,742).—A memorandum of satisfaction in full of a charge dated May 21st, 1903, securing £1,500, has been filed.

Bournemouth and Poole Electricity Supply Co., Ltd.—A series of debentures created by resolutions of March 5th, 1900, and July 16th, 1903, to secure an amount not exceeding half the subscribed capital for the time being (now £270,000) has been registered. Property charged: The company's undertaking and property, present and future. No trustees. Debentures are issued to trustees for holders of debenture stock securing same amount, acting under deed of March 5th, 1900.

J. L. Pulvermacher & Co., Ltd., medical electricians, London (47,632).—A debenture, dated November 13th, 1903, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holders: G. B. Browne, 45 and 47, Ludgate Hill, E.C.; and D. G. H. Pollock, 5, Threadneedle Street, E.C.

Langdon-Davies Motor Co., Ltd., formerly "Langdon-Davies Electric Motor Co., Ltd." (55,880).—Issue, on October 26th, of £200, and on November 12th, of £400 debentures, part of series created October 15th, 1902, to £6,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £4,800.

Woking Electric Supply Co., Ltd. (46,175).—Issue, on October 31st, of a debenture for £50, part of series created November 2nd, 1899, to secure £25,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustee. Previously issued of same series: £22,550.

City of Wellington Electric Light and Power Co., Ltd. (39,003).—Issue, on November 5th, of £75,000 5 per cent. first debentures, part of series created May 7th, 1903, to secure £100,000. Property charged: The company's undertaking and property, present and future. No trustees. No previous issue of same series.

Monte Video Telephone Co., Ltd. (27,208).—This company's annual return was filed on November 20th, when 86,492 preference and 72,680 ordinary shares had been taken up out of a nominal capital of £160,000 in 87,000 preference and 73,000 ordinary shares of £1 each. £159,172 is considered as paid. Mortgages and charges: Nil.

Mather & Platt, Ltd. (60,837).—This company's annual return was filed on September 24th, when 40,000 preference and 40,000 ordinary shares had been taken up out of a nominal capital of £1,000,000 in 50,000 preference and 50,000 ordinary shares of £10 each. £10 per share has been called up on 21,705 preference and 2,500 ordinary and £7 10s. per share on 7,495 preference shares, resulting in the receipt of £298,262 10s. £483,000 is considered as paid on 10,800 preference and 87,500 ordinary shares. No mortgages or charges.

Sir Hiram Maxim Electrical and Engineering Co., Ltd. (61,969).—This company's annual return was filed on September 30th, when the entire capital of £190,000 in £1 shares had been taken up. £1 per share has been called up on 42,500 shares, resulting in the receipt of £37,222 12s. 6d. £5,207 7s. 6d. remains in arrears. £147,500 shares are considered as fully paid. Mortgages and charges: £20,000.

F. A. Glover & Co., Ltd., electrical engineers, London (73,356).—Issue, on November 14th, of a debenture for £500, part of series created April 11th, 1902, to secure £6,000, charged on the company's undertaking and property, present and future, including uncalled capital (if any). No trustees. Previously issued of same series: £5,000.

Conduit and Insulation Co., Ltd. (50,527).—This company's annual return, made up to August 26th, has been filed. 33,878 shares have been taken up out of a nominal capital of £40,000 in £1 shares. £15,878 has been paid, and 18,000 shares are considered as fully paid. No mortgages or charges.

British Prometheus Co., Ltd., electrical cooking apparatus manufacturers, Kingston-on-Thames.—£2,500 debentures, created October 17th, 1903, and dated November 7th, 1903, charged on the company's undertaking and property, present and future, including uncalled capital, have been registered. No trustees.

British Electric Car Co., Ltd.—£25,000 second debentures' created November 6th, 1903, have been registered. Property charged (as a floating security): The company's undertaking and property, present and future, including uncalled capital, subject to £50,000 debenture stock secured by trust deed dated June 17th, 1903. No trustees.

London Electrical Fittings Co., Ltd. (62,468).—This company's annual return was filed on October 3rd, when 2,999 shares had been taken up out of a nominal capital of £3,000 in £1 shares. £1,299 has been received, and £1,700 is considered as paid. No mortgages or charges.

Electrical Indicator Syndicate Co., Ltd. (28,431).—A debenture, dated November 18th, 1903, to secure £200, charged on the company's property, present and future, has been registered. Holder: W. H. Callow, Highbury Hill, N. Also issue, on November 18th, of a second debenture for £x00, part of series created same date to secure £1,000, charged on same property. No trustees.

ELECTRICITY SUPPLY ACCOUNTS.

Leeds Municipal Electrical Supply.

We give herewith the returns of the Leeds electric lighting department for the year ending March 25th last; the undertaking, since it was acquired by the Corporation in 1898, has made great progress, as will be gathered from the fact that some 13,700 H.P. of plant is now installed, and the output has reached 4,323,821 units. The rapidly growing motor load is a valuable feature, and should enable the department to show an improvement on what are at present excellent works costs, on a load factor under 13 per cent. During the year a fall of ½d. per unit in the average revenue has to be recorded; this has had an adverse effect on the percentage of revenue to capital expended, compared with previous years. The prices charged are:—Private lighting, 4d. per B.T.U., power, 2d. to 1½d. per unit, dependent on the number of units used per horse-power of maximum demand; for heating purposes, 2d. per unit. In all cases discounts are allowed.

Mr. H. Dickinson is the electrical engineer and manager.

General Statement.

For year ending March 25th—	1903.	1902.
Total capital expended	£671,412	£505,029
Number of units sold—		
Private supply	4,323,821	3,055,165
Public lighting	124,829	—
Total number of units sold	4,448,650	3,055,165
Equivalent No. of 8-c.p. lamps connected	231,734	178,422
H.P. of motors connected	1,437	685
Number of public lamps	93 arc	1 arc
Maximum load in KW.	4,126	3,110
Revenue account—		
Gross revenue	£56,656	£45,332
„ expenditure	£19,997	£14,511
„ profit	£36,659	£30,821
Average price obtained—		
Private lighting	3·06d.	3·58d.
Public lighting	1·50d.	—

Revenue Account.

	1903. Gross.	1903. Per unit.
By sale of energy	£55,972	3·02d.
Meter rents, &c., excess provided for taxes and refunded	684	·04d.
Gross revenue	£56,656	3·06d.

Cost of Production.

	Gross.	Per unit.
Coal, &c.	£5,225	·28d.
Oil, waste, water and engine room stores ...	608	·03d.
Wages incurred in generation and distribution	3,799	·20d.
Repairs and maintenance of buildings, machinery, and plant...	1,892	·10d.
Works and distribution costs	£11,524	·61d.
Rent, rates and taxes	1,495	·08d.
Management expenses, salaries of engineer and clerical staff	2,718	·15d.
General establishment charges, insurance, law, printing and stationery...	729	·04d.
Special charges due to change of voltage and rewinding alternators	3,531	·19d.
Total works costs ...	£19,997	1·07d.

Profit Statement.

Interest on loans	£22,404
Sinking fund	12,872
Surplus for 1903	1,383
Gross profit ...	£36,659

On the year's working a gross profit of £36,659 was earned, as compared with £30,821 in the previous year, and after meeting financial charges, which have latterly taken an upward turn due to large extensions, a balance of £1,383 remains, as compared with £3,170 in the previous year.

CITY NOTES.

Allgemeine Elektricitäts Gesellschaft.

The report of the directors states that the events of the financial year ended June 30th, 1903, seem to have confirmed the previous suggestions in regard to the necessity of a closer connection being established between the large firms if prices were again to be brought to a remunerative level, and that the first step in this direction had been taken by the combination of the four most important undertakings into two groups, which represent more than three-fourths of the total production of the country. It was to be desired and hoped that the centralising movement in the electro-technical industry would continue. The decision which introduced this movement—the institution of a community of interests with the Union Electricity Co.—was arrived at on the occasion of the general meeting held last April, and the working arrangement commenced on July 1st. It did not, therefore, affect the results of the past year. Since then the projected fusion of the administration, particularly in the German branch establishments, and a distribution of work in the shops, had been carried into effect, and appeared to promise well. The same wish for concentration led to the company's co-operation in the conversion of the well-known firm of Körting Bros., of Hanover, into a company with a capital of £800,000, in which the A.E.G. participated to the extent of £55,000. The electrical department of the Hanover firm was taken over by the A.E.G., and organised as a company specially for the production of generator gas installations for electrical and other purposes. A result of further understanding was the company's co-operation with the Siemens & Halske Co. for the technical and commercial development of wireless telegraphy on the Slaby-Arco and Braun systems, and more recently by the participation on joint account in the construction of large works at Valparaiso for lighting, power, and railway working. It was proposed to pay a dividend at the rate of

8 per cent. as in the previous year. The company had transferred to friendly banks shares amounting to £200,000 in the Zurich Bank for Electrical Enterprises, and realised a profit of £94,460. This profit was not distributed as dividend, but a portion of it had been devoted to the purpose of defraying some of the expenses of erecting large new buildings and providing workshop equipment, and the remainder placed to the reserve fund. A larger number of orders was received than in the previous year, and on October 1st the officials and workmen were 18,278 as compared with 14,897 on the same day in the corresponding 12 months. The turnover in the Brunnenstrasse machine works increased by over 25 per cent. For instance, the number of dynamos and motors built reached 22,443 of a total output of 294,941 H.P. as compared with 15,283 of 211,861 H.P. in 1901-2, and 21,850 of 268,100 H.P. in 1900-1. The construction of dynamos of all sizes up to 6,000 H.P. was carried out, and new types of oil and air transformers were introduced, while large sizes of winding engines for main shafts of mines were also delivered. The report proceeds to refer to the promotion of steam turbine construction and to the improvement of the Nernst lamp, of which about 2,000,000 have been supplied, and for which an increasing demand was being experienced. An international combination of glow lamp makers had been formed with a sales bureau in Berlin for the regulation of prices which had constantly declined for years. The employment of the cable factory had in general been satisfactory, and night shifts had been partly worked in some branches. The brass rolling mill was started at the end of the winter, and had plenty of orders to keep it in operation; while the automobile factory would be mainly devoted to the improvement of special types and the construction of heavy motor-cars for goods, new shops having been erected for this purpose. After mentioning the numerous installations carried out for public authorities and ships, mines, and at the harbours of Table Bay, Cape Town, Barcelona and St. Petersburg, and the provision or extension of equipment at central stations, the report states that a slight improvement in electric railway conditions was perceptible, and that the construction of railway signalling and safety appliances, which were expected to come more into use with the adoption of electric traction on main lines, had been undertaken, and an interest taken in an important firm engaged in that branch of industry. The high speed experiments on the Marienfeld-Zossen railway are briefly mentioned, and the rate of over 125 miles an hour recorded as having been attained. After deducting the interest on the company's bonds, the gross profits, including the balance from the previous year, amount to £360,904, and, having provided for expenses, taxes and depreciation, the sum available for disposal is £281,219. The dividend at the rate of 8 per cent. on a capital of £3,000,000 absorbs £240,000, the fees of the board of supervision £6,000, grants to official and benevolent funds £12,000, and pension and assistance fund £12,000, while the balance is carried forward to the next account.

Bullers, Ltd.

THE report for the year ended July 31st states that additional buildings and plant and machinery have again been required at both Hanley and Tipton to meet increased demands. The company has received large orders in connection with the electrification of railways and the transmission of electrical power at very high tension. These promise to be important developments of the company's business. The trading accounts, after paying directors' fees and managing directors' salaries, show a profit of £40,058, which, with £775 brought forward, makes a total of £40,833. The interest on the preference shares, and dividends of 7½ per cent. on the ordinary shares have been paid, leaving a balance of £22,083. The directors propose to pay a further 2½ per cent. on the ordinary shares, making 10 per cent. in all; to place £10,000 to reserve, which will then amount to £40,000; to pay a bonus of 5 per cent. on the ordinary shares, and to carry forward £833. In September, 1903, a further purchase of £15,000 Consols was made, which, with the £15,000 purchased in September, 1901, makes a total of £30,000.

Aron Electricity Meter, Ltd.

THE directors' report for the year ending September 30th, 1903, shows that the profit and loss account for the year, after providing for depreciation and share of expenses and discount on the issue of debentures, shows a net profit of £2,125 18s. 8d., which has been carried to the debenture sinking fund in accordance with the provisions of the trust deed. The report reads:—

> The directors are pleased to record a considerable change for the better in the affairs of the company, which may be ascribed to the following causes:—
> The apparent revival of the electrical industry on the Continent has created a proportionately larger demand for Aron meters, especially in Germany.
> The completion of the factory at Schweidnitz has enabled the company to manufacture both cheaper and more advantageously.
> The manifest advantages of the Aron meter have created a reaction in its favour, which is distinctly noticeable in quarters where other instruments were afforded encouragement in recent years.
> The increased sales during the last year led your directors to expect better results than had actually been attained; the economies effected in the manufacture have, however, so far not been sufficiently large to compensate for the required reduction in the selling prices. The directors have persevered in their efforts to stimulate business in England, and the expenditure incurred thereby has materially reduced the profits for the year. Prof. Aron has successfully completed his experiments in connection with the production of a new and cheap meter for alternating currents, which will shortly be placed on the market.

Western Telegraph Co.—Interim dividend, payable on December 21st, of 3s. per share (at the rate of 6 per cent. per annum), for the quarter ended September 30th, 1903.

STOCKS AND SHARES.

Wednesday Evening.

SPECULATION as a motive power to the markets has again fallen flat, but the Kaffir Circus once more steps aside to allow Consols the position of leader in the Stock Exchange; and Consols have been put up with a spurt, upon a variety of causes familiar to everyone who takes interest in the markets, the advance including other investment varieties in its train. While it is too much to say that business gives any fresh signs of broadening out, the situation seems healthy enough, apart from the troubled waters in the Far East. Fortunately, the money squeeze usual at this time of the year has scarcely been perceptible so far, and cash accommodation continues to be obtainable upon reasonable terms.

Railway stocks are the chief centres of animation in the markets we touch upon, and the Undergrounds have advanced into fresh favour. Metropolitan Consolidated again scores with a further jump of 1½ to 88½, and now Districts are commencing to follow them in the upward track, having risen no less than 4½ to 36¼. This last movement is due to the publication of the ambitious schemes advertised as the goal of the Yerkes group, with their 17 millions of capital and over 100 miles of railway. Metropolitans owe some of their strength to the decision given in favour of the company with respect to running powers over part of the Circle, but the consideration did not affect Districts, and there is an idea that the case may yet be carried to the House of Lords.

Central London Ordinary is up a point, but City and South London slipped back to the round 50, and the company's prior securities are also losing ground. Its three Preference stocks stand at 128½, 125½ and 122½, while the 14 per cent. Debenture is not better than 110½. Central London 4 per cent. Debenture is 116½, and the gilt-edged market suffers sorely from the new issues of high-class stocks now being offered at low prices by several of the steam railway companies. It is said, too, that there are still others to come.

So the weakness in London United Tramways shares must not be ascribed to ideas of a fresh capital issue, but is attributed by "good authority," as an evening contemporary veiledly remarks, to the dearness of money and sympathy with the weakness of other similar stocks. The price of Preference has hardened a little to 11½, and the Debentures are 105. The Tramway market presents few features of interest this week, but British Electric Traction Preference have advanced ¼, the recent tap being turned off for a time.

Electricity supply shares have a pair of rises to show against a trio of falls. One of each is accounted for by a movement of 1 per cent. in Debenture stocks, and the other rise is that of ¼ in City of London Ordinary shares, upon a recent decision of the Common Council and the approach of the dividend time. This latter consideration, however, has failed to save Brompton Preference from a decline of 5s., and a similar fall brought South Londons down to 3½. Primitiva Gas and Electric of Buenos Ayres Debenture was dealt in at 82 and 83 the other day, but the Ordinary shares at 4 and the Preference at 4¼ are neglected.

Several of the manufacturing descriptions show changes on the week. Henley's, for instance, are ¼ up, and British Aluminium Preference have improved to 7, the Debenture hardening a couple of points to 90. Brush Second Debenture rose 1 to 88½ upon a small inquiry. Callender's have not fluctuated.

Amongst telegraph descriptions, the principal movement is a rise of £2 in Great Northerns, following their advance of 10s. last week. The buying emanates from Paris, where a good deal is done in the shares, and where the supply is apparently as limited as it is here. The Eastern group keeps steady, but "Chinas" slipped back to 11½, after being nearly 12. Eastern Telegraph Ordinary remains at 124½, and the Anglo-American group is almost motionless too Anglo "A," the Deferred stock, has lost the ¼ that it gained a week ago, upon more chastened impressions in regard to the coming dividend declaration. West India and Panama first Preference have gone back ½ to 6½—a reaction readily accounted for by their recent sharp rise and consequent temptation to sellers. None of the Telegraph Trust varieties have any alteration to exhibit, and practically the same remark covers the telephone section, where a fair amount of business continues to be done in the National Co.'s stocks, although the only quotable change is a point fall in the Deferred.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—Metropolitan District Railway Co.—Partly paid scrip of a further issue of £500,000 4 per cent. perpetual debenture stock. The Committee has further been asked to allow the following to be quoted in the Official List:—Blackheath and Greenwich District Electric Light Co., Ltd.—50,000 7 per cent. cumulative preference shares of £1 each, fully paid.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1900.	1901.	1902.	Closing Quotations Nov. 25th.	Closing Quotations Dec. 2nd.	Business done week ended Dec. 2nd, 1903. Highest	Lowest.
67,100	African Direct Telegraph, 4 % Debs.	100	..	..	..	99 —103	99 —103	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	..	..	..	2½— 3¼	2½— 3¼	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	..	..	..	70 — 80	70 — 80	..	..
788,840	Anglo-American Telegraph	Stock	3½%	61s.	60/6	49 — 52	49 — 52	..	..
3,105,580	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	92 — 94	92 — 94	93⅞	93½
3,105,580	Do. do. do. Deferred	Stock	5s. %	2s.	1/-	8 — 8¼	7⅞— 8¼	7 11/16	7⅞
44,000	Chili Telephone, Nos. 1 to 44,000	5	5 %	5 %	6 %	4¾— 5¼	4¾— 5¼	..	..
13,333,300$	Commercial Cable	$100	8 %	8 %	8 %	145 —155	145 —155	..	..
1,841,209	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	..	..	..	90 — 93	90 — 93	92	90½
16,000	Cuba Telegraph	10	4½%	4 %	6½%	7 — 8	7 — 8	..	..
6,000	Do. 10 % Pref.	10	..	..	..	16 — 17	16 — 17	..	..
12,981	Direct Spanish Telegraph	5	4 %	4 %	4 %	2¾— 3¼	2¾— 3¼	..	..
6,000	Do. do. 10 % Cum. Pref.	5	..	..	..	7 — 8	7 — 8	..	..
20,000	Do. do. 4½ % Debs.	50	..	..	..	97 —101	97 —101	..	..
60,710£	Direct United States Cable	20	3½%	3½%	3½%	10¼— 10¾	10¼— 10¾	10½	..
87,800	Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,200, Red.	100	..	..	..	99 —102	99 —102	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	122 —127	122 —127	123½	122
1,955,565	Do. 3½ % Pref. Stock	100	..	..	..	84 — 87	84 — 87	86	85
1,584,645	Do. 4 % Mort. Deb. Stock Red.	Stock	..	..	..	105 —108	105 —108	..	..
800,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	11½ — 12	11 — 11¼	11 5/16	11
820,000£	Do. 4 % Deb. Stock	Stock	..	..	..	105 —108	105 —108	..	..
300,000	Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 3,000, red. 1909	100	..	..	..	99 —102	99 —102	99¼	..
200,000£	Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000	25	..	..	..	99 —102	99 —102	..	..
180,227	Globe Telegraph and Trust	10	5½%	5½%	..	8¼— 8¾	8¼— 8¾	8⅝	8 7/16
180,042	Do. do. 6 % Pref.	10	..	..	..	12¾— 13	12¾— 13	12⅞	12 7/16
160,000	Great Northern Telegraph, of Copenhagen	10	15 %	15 %	12½%	23 — 24	25 — 26	25⅜	24½
62,500£	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	..	..	..	99 —102	99 —102	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	10%	36 — 39	37 — 40	39	38½
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	..	..	..	98 —102	98 —102	..	..
1,988,333	National Telephone, Pref. Stock	100	5 %	5 %	6 %	101 —103	101 —103	102⅔	101
1,966,667	Do. do. Def. Stock	100	..	..	4½%	79 — 81	78 — 81	80½	79
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	13 — 14	13 — 14	..	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	13 — 14	13 — 14	..	..
2,250,000	Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000	5	5 %	5 %	5 %	5¼— 5⅝	5¼— 5⅝	5 3/16	..
000,000£	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	95 — 97	95 — 97	96¼	95½
600,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	102 —104	102 —104	..	..
179,313	Oriental Telephone and Elec. Nos. 1 to 171,504, fully paid	1	6 %	6 %	6 %	13/16— 15/16	13/16— 15/16	..	..
50,000	Do. do. do. 6 % Cum. Pref.	1	..	..	..	.. — ..	1 — 1⅛	..	..
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	..	..	..	97 —100	97 —100	..	..
11,889	Reuter's	8	5 %	5 %	..	6¾— 7¼	6¾— 7¼	..	..
8,308	Submarine Cables Trust	Cert.	..	..	..	116 —121	116 —121	..	..
58,000	United River Plate Telephone	5	7 %	7 %	7 %	5¾— 6	5¾— 6	5 13/16	..
40,000	Do. do. 5 % Cum. Pref., Nos. 1 to 40,000	5	..	..	..	4¾— 5¼	4¾— 5¼	..	..
179,947£	Do. do. 5 % Debs.	Stock	..	..	..	104 —107	104 —107	..	..
15,609	West African Telegraph, Shares	10	..	..	2 %	5 — 6	5 — 6	..	..
150,000£	West Coast of America, 4% Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	..	..	..	95 — 98	95 — 98	..	..
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	7 %	11¾— 12¼	11¾— 12¼	12⅛	11¾
75,000£	Do. do. 5 % Debs. 2nd series, 1906	100	..	..	..	100 —103	100 —103	..	..
400,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	98 —101	98 —101	100	9 3/4
82,921	West India and Panama Telegraph	10	1¾%	..	..	7/16— 9/16	7/16— 9/16	..	..
84,563	Do. do. do. 6 % Cum. 1st Pref.	10	..	..	..	6¼— 6¾	6 — 6¼	..	..
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	..	..	..	4 — 5	4 — 5	..	..
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	..	..	..	101 —104	101 —104	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

20,000	British Aluminium 7 % Cum. Pref.	10	..	..	..	4¼— 5¼	4¼— 5¼	..	..
800,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	..	..	..	86 — 90	88 — 92	90	..
100,000	British Electric Traction	10	9 %	9 %	8 %	11¼ — 12	11½ — 12	11 11/16	11 11/16
100,000	Do. do. 6 % Cum. Pref.	10	..	..	..	11 — 11½	11½ — 11⅝	11⅝	11⅝
600,000£	Do. do. 5 % Perpetual Debenture Stock	Stock	..	..	..	120 —123	120 —123	123	122½
100,000	British Insulated and Helsby Cables	£ 5	15 %	10 %	10 %	6 — 6¼	6 — 6¼	..	..
100,000	Do. do. 6 % Cum. Pref.	£ 5	..	..	..	5¼— 5½	5¼— 5½	..	..
50,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	..	..	..	108 —108	108 —108	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	8 %	Nil	..	1/16— 1/8	1/16— 1/8	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	6 %	6 %	..	14/6 to 15/6	14/6 to 15/6	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	5 %	Nil	Nil	1/2— 1¼	1/2— 1¼	1/16	..
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	3 %	6 %	1¼— 1½	1¼— 1½	1½	..
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	..	..	..	97 —100	97 —100	98¾	..
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	..	..	..	85 — 90	84 — 89	..	..
85,000	Callender's Cable Construction shares	5	15 %	20 %	15 %	11 — 12	11 — 12	..	..
40,000	Do. do. do. 5 % Cum. Pref.	5	..	..	..	5¼— 5⅜	5¼— 5⅜	..	..
90,000£	Do. do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	..	..	..	106 —110	106 —110	..	..
1,860,014	Central London Railway, Ord. Stock	Stock	..	4 %	4 %	91 — 94	92 — 95	93½	93⅛
494,098	Do. do. 4 % Pref. Stock	Stock	..	4 %	4 %	99 —102	99 —102	100	..
494,998	Do. do. Def. do.	Stock	..	4 %	4 %	96 — 99	96 — 99	16⅜	..
1,880,000	City and South London Railway	Stock	1½%	2 %	3½%	50 — 52	49 — 51	50	49
85,000	Crompton & Co., Nos. 1 to 85,000	8	8 %	7½%	5 %	1¾— 2¼	1¾— 2¼	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., to 900 of £100, and 901 to 11,000 of £50 red.	..	..	..	..	100 —104	100 —104	..	..
99,261	Edison & Swan United Elec. Light, "A" shares, £8 paid, 1 to 99,261	5	2½%	Nil	..	0 — ¼	0 — ¼	..	..
17,139	Do. do. "A" shares, 01—017,139	5	2½%	Nil	..	1 — 2	1 — 2	..	..
344,028£	Do. do. 4 % Deb. Stock Red.	100	..	..	..	72 — 77	72 — 77	..	..
100,000£	Do. do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	..	..	..	76 — 81	76 — 81	..	..
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	6 %	1¼— 1⅝	1¼— 1⅝	..	..
81,390	Do. do. 7 % Cum. Pref., 1 to 81,390	2	..	..	..	2¾— 3	2¾— 3	..	..
82,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock	Stock	..	..	..	97 —100	97 —100	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	9¾— 10¼	9¾— 10¼	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	..	..	..	96 — 99	96 — 99	..	..
85,000	Henley's (W. T.) Telegraph Works, Ord.	5	20 %	20 %	20 %	14 — 14½	14 — 15	..	..
35,000	Do. do. 4½ % Pref.	5	4½%	..	..	5 — 5¼	5 — 5¼	..	..
48,050	Do. do. 4½ Mort. Deb. Stock	Stock	..	..	..	108 —112	108 —112	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works	10	10 %	10 %	10 %	18 — 19	18 — 19	18¾	..
800,000£	Do. do. do. 4 % 1st Mort. Deb.	100	..	..	..	100 —103	100 —103	..	..
87,500	†Liverpool Overhead Railway, Ord.	10	3½%	1½%	1½%	4¾— 5	4¾— 5	..	..
10,000	† Do. do. Pref. £10 paid	10	..	..	..	10¼— 10¾	10¼— 10¾	..	..
37,350	Telegraph Construction and Maintenance	12	17½%	20 %	20 %	34 — 37	34 — 37	34⅜	34⅜
150,000£	Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909	100	..	..	..	101 —104	101 —104	..	..
540,000£	Waterloo & City Railway, Ord. Stock	100	3 %	3 %	3½%	91 — 94	91 — 94	..	..

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ From Manchester Share List.

Bank rate of discount 4 per cent. (September 3rd, 1903).

SHARE LIST OF ELECTRICAL COMPANIES (*continued*).—ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1900.	1901.	1902.	Closing Quotations Nov. 25th.	Closing Quotations Dec. 2nd.	Business done week ended Dec. 2nd, 1903. Highest	Lowest
100,000	Blackheath and Greenwich Dist. Electric Light, Ord...	‡ 1	..	..	..	5/8 — 3/4	5/8 — 3/4	..	..
100,000	Do. 4½% 1st Deb. Stock, Prov. Certs.	100	..	..	..	116 —119	116 —119	..	..
20,000	Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000	5	6 %	8 %	8 %	10¾ — 10¾	10¾ — 10¾	..	..
20,000	Do. do. 7 % Cum. Pref.	5	..	..	..	10¾ — 10¾	10 — 10⅛	10¼	..
50,000	Charing Cross and Strand Electricity Supply	5	9 %	10 %	10 %	10 — 10¼	9 — 9⅜	9⅜	9⅛
70,000	Do. do. do. 4½% Cum. Pref.	5	..	..	..	5¼ — 5⅜	5¼ — 5⅜	..	..
40,000	Do. do. "City Undertaking" 4½% Cum. Pref.	5	..	..	..	4⅜ — 5	4⅜ — 5	..	..
250,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	104 —106	105 —107	106	..
44,436	*Chelsea Electricity Supply, Ord.	5	5½%	4 %	4½%	5⅜ — 6	5¼ — 6	5⅜	..
150,000‡	Do. do. % Deb. Stock Red.	Stock	..	..	..	108 —111	107 —110	..	..
70,595	City of London Electric Lighting, Ord. 40,001—110,595	10	0 %	5 %	5 %	10 — 10¼	10¼ — 10⅜	..	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	..	..	13 — 14	13 — 14	13⅜	..
400,000‡	Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid ..	..	..	..	..	122 —127	122 —127	125	123½
300,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	..	..	..	102 —105	102 —105	105¼	105
40,000	County of London & Brush Prov. Electric Lighting, Ord. 1—40,000.	10	4 %	4 %	4 %	7⅜ — 8¼	7⅜ — 8¼	..	..
20,000	Do. do. do. 6 % Pref., 40,001—60,000.	10	..	..	..	11⅜ — 12¼	11⅜ — 12¼	..	..
400,000‡	Do. do. 4½% Deb. Stock	..	..	..	..	108 —111	108 —111	..	..
250,000	Do. do. 4½% 2nd Deb. Stock	Stock	..	..	..	99 —102	99 —102	..	..
50,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	7 %	6¼ — 6⅜	6¼ — 6⅜	6¼	..
80,000	Do. do. 6 % Cum. Pref.	..	..	..	..	6 — 6⅛	6 — 6⅛	6⅛	6⅛
140,000	Do. do. 4½% 1st Mort. Deb. Stock ..	100	..	..	..	104 —107	104 —107	..	..
21,000	Kensington and Knightsbridge Electric, Ord.	5	12 %	10 %	10 %	10⅜ — 11⅛	10⅜ — 11⅛	..	..
90,000	Do. do. do. 4 % Debenture Stock ..	Stock	..	..	..	101 —104	101 —104	..	..
110,000	London Electric Supply Corporation, Limited, Ord.	3	..	..	..	1⅜ — 2⅛	1⅜ — 2⅛	..	..
49,840	Do. do. do. 6 % Pref.	5	..	..	..	5 — 5⅛	5 — 5⅛	5⅛	..
250,000‡	Do. do. do. 4 % 1st Mort. Deb. Stock Red	Stock	..	..	..	98 —101	98 —101	100¼	..
100,000	Metropolitan Electric Supply, 1 to 100,000	10	6 %	6½%	7½%	17⅛ — 18½	17⅛ — 18½	18⅛	17⅞
71,106	Do. do. 4½% Cum. Pref. 1—71,106, £3 paid ..	5	..	..	..	4⅜ — 4⅝	4⅜ — 4⅝	4⅜	..
220,000‡	Do. do. 4½% 1st Mort. Deb. Stock	..	..	..	..	110 —114	110 —114	..	..
250,000‡	Do. do. 3½% Mort. Deb. Stock Red	Stock	..	..	..	96 — 99	96 — 99	..	..
10,852	Notting Hill Electric Lighting	10	7 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14 — 15	14 — 15	14⅜	14¼
20,000	Do. do. do. 7 % Pref. 20,081 to 40,080	5	..	..	..	7⅞ — 8¼	7⅞ — 8¼	8⅛	..
150,000‡	Do. do. do. 3½% Deb. Stock Red ..	100	..	..	..	98 —101	98 —101	100	99⅞
12,000	Smithfield Markets Electric Supply, Ord.	5	..	..	2½%	3 — 3½	3 — 3½	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	..	..	..	— —	85 — 90	..	..
65,000	South London Electricity Supply, Ord.	5	..	..	12½%	3¼ — 4	3¼ — 3⅜	..	..
30,000	Urban Electric Supply, Ord.	5	..	..	..	4⅜ — 5⅛	4⅜ — 5⅛	4⅜	..
30,000	Do. do. 5 % Cum. Pref.	5	..	..	..	4⅜ — 5⅛	4⅜ — 5⅛	4⅜	..
110,000	Westminster Electric Supply, Ord.	5	10½%	10½%	12 %	11½ — 12½	11½ — 12½	12⅜	12⅛
28,141	Do. do. 5 % Cum. Pref.	5	..	..	..	6 — 6½	6 — 6½	6	..

*Subject to Founders Shares. ‡ Unless otherwise stated all shares are fully paid.

MARKET QUOTATIONS, Wednesday, December 2nd.

CHEMICALS, &c.		Latest Price.	Week's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	32/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£38 10	..
a ,, ,, ...	per ton	£80	..
a Bleaching powder	per ton	£4 10	..
a Bisulphide of Carbon	per ton	£15	..
a Borax	per ton	£13	..
a Benzole (90 %)	per gal.	7/-	..
a ,, (50/90 %)	per gal.	5/6	..
a Copper Sulphate	per ton	£20	..
a Lead, Nitrate	per ton	£24	..
a ,, White Sugar	per ton	£31	..
a ,, Peroxide	per ton	£27 10	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90% a 160° C).	per gal.	5/6	..
a Potash, Bichromate, in casks ..	per lb.	3d.	..
a ,, Caustic (75/80%).. ..	per ton	£24	..
a ,, Bisulphate	per ton	£35	..
a Shellac	per cwt.	235/-	4/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a ,, Crystals	per ton	£3	..
a ,, Bichromate, casks.. ..	per lb.	2½d.	..

METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£180	..
b ,, Wire, in ton lots ..	per ton	£168	..
b ,, Sheet, in ton lots ..	per ton	£166	..
p Babbitt's metal ingots	per ton	£43 to £130	..
c Brass (rolled metal 2" to 12") basis	per lb.	6⅞d.	..
c ,, Tube (brazed)	per lb.	8⅜d.	..
c ,, ,, (solid drawn).. ..	per lb.	7⅛d.	..
c ,, Wire, basis..	per lb.	7d.	..
c Copper Tubes (brazed)	per lb.	9½d.	..
c ,, ,, (solid drawn) ..	per lb.	9½d.	..
g Copper Bars (best selected ..	per ton	£71	..

METALS, &c. (*continued*).		Latest Price.	Week's Inc. or Dec.
g Copper Sheet	per ton	£71	..
g ,, Rod	per ton	£71	..
c ,, (Electrolytic) Bars ..	per ton	£68	..
c ,, ,, Sheets ..	per ton	£78	..
c ,, ,, Rod ..	per ton	£75	..
c ,, ,, H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	per lb.	3/8	..
f ,, Sheet	per lb.	3/-	..
n German Silver Wire	per lb.	1/6	..
h Gutta-percha fine	per lb.	8/-	..
h India-rubber, Para fine	per lb.	3/11 to 4/-	..
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	42/8	..
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8 ..	per ton	£9 15	..
g Lead, English Ingot	per ton	£11 7 6 to £11 10	..
g ,, ,, Sheet	per ton	£18	..
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 5	2/6 dec.
d Mica (in original cases) small ..	per lb.	4d. to 1/6	..
d ,, ,, ,, medium	per lb.	2/6 to 8/9	..
d ,, ,, ,, large ..	per lb.	4/- to 7/9	..
p Phosphor Bronze, plain castings	per lb.	1/- to 1/2½	..
p ,, rolled bars & rods	per lb.	1/- to 1/3	..
p ,, ,, strip & sheet	per lb.	From 1/1	..
o Platinum	per oz.	£4	..
p Silicium Bronze Wire	per lb.	9d. to 11d.	..
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
i ,, ,, in bars		£15 to £40	..
g Tin, Block	per ton	£123	30/- to 50/- inc.
g ,, Foil	per lb.	1/6	..
n ,, Wire, Nos. 1 to 16	per lb.	1/6½	½d. dec.
p White Anti-friction Metals— "White Ant" brand ..	per ton	£42 to £62	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	8d.	..
j ,, 6 lea. Flax	per lb.	5½d.	..
j ,, 8 ply 10 lbs. Russian ..	per lb.	4⅛d.	..
j ,, 10 lbs. Russian, single ..	per lb.	4½d.	..
j ,, 180 lbs. Jute rove	per ton	£11	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£23 15	..

Quotations supplied by Messrs.:—*a* G. Boor & Co.; *b* The British Aluminium Co., Ltd.; *c* Thos. Bolton & Sons., Ltd.; *d* F. Wiggins & Sons.; *e* Frederick Smith & Co.; *f* India-Rubber, G.P. and Teleg. Works Co., Ltd.; *g* James & Shakspeare; *h* Edward Till & Co.; *i* Bolling & Lowe; *j* Walter H. Hindley and Co., Ltd.; *k* Morris Ashby, Ltd.; *m* W. T. Glover & Co., Ltd.; *n* P. Ormiston & Sons; *o* Johnson, Matthey & Co., Ltd.; *p* The Phosphor Bronze Co., Ltd.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RECEIPTS.

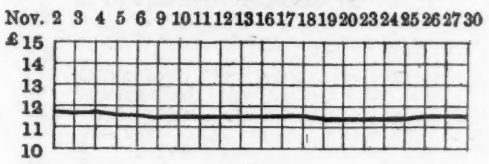
	Locality.	Week ending	Receipts for the week. £	£*	Total to date. £	£*	Miles open.	*
	Aberdeen	Nov. 28	1,077	+227	32,750	+ 5,505	10	—
	Birmingham	,, 28	4,966	+161	244,200	+ 9,641	—	—
	Bournemouth	,, 25	778	—	—	—	10½	—
	Blackburn	,, 27	700	+ 22	30 276	+ 912	12½	+1½
	Blackpool	,, 26	293	+ 14	86,628	— 183	8½	—
	Blackpool and Fleetwood	,, 28	160	— 28	20,083	— 188	7½	—
	Blackpool and Lytham ..	,, 19	107	+ 87	459	+ 209	—	—
	Bolton	,, 29	1,685	+158	64,980	+ 7,858	25	—
	Bradford	—	—	—	—	—	41	+4
	Brighton	,, 29	784	+ 36	33,239	—	6½	—
	Bristol	,, 27	4,350	+227	—	—	28	—
	Burnley	,, 28	741	+ 87	—	—	7½	—
British Elec. Trac. Co.	Barnsley District ..	,, 20	166	— 3	8,284	— 30	4½	—
	Devonport	,, 20	467	+121	21,476	+ 1,344	5	—
	Dudley—Stourbridge..	,, 20	768	+ 40	38,989	+ 3,668	18½	—
	Gateshead	,, 20	900	+ 62	40,799	+ 5,291	10½	+ ½
	Gravesend—Northfleet	,, 20	217	+ 47	11,286	+ 1,171	8½	—
	Greenock—Pt. Glasgow	,, 20	468	+ 44	25,505	+ 2,079	7½	—
	Hartlepool	,, 20	945	+ 34	12,627	+ 787	6½	+2
	Kidderminster	,, 20	96	+ 3	5,980	+ 169	4½	—
	Merthyr	,, 20	184	+ 30	9,261	— 60	3	—
	Middleton	,, 20	250	+ 16	14,864	+ 1,827	8½	—
	Oldham—Ashton ..	,, 20	511	—	26,106	+ 1,579	8	—
	Peterborough	,, 20	110	—	6,886	—	—	—
	Poole	,, 20	224	+ 28	14,198	+ 2,058	8½	—
	Potteries	,, 20	1,659	— 51	78,675	+ 3,562	28½	—
	Rothesay..	,, 20	86	— 8	6,810	+ 1,608	2½	—
	Sheerness	,, 18	50	—	2,809	—	2½	—
	Southport	,, 20	249	+ 27	14,681	+ 2,574	5½	—

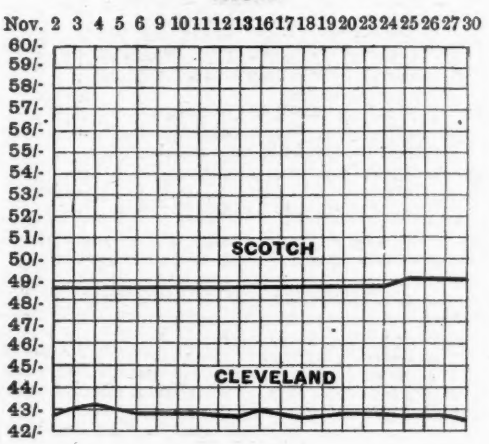
	Locality.	Week ending	Receipts for the week. £	£*	Total to date. £	£*	Miles open.	*
	South Staffordshire ..	Nov. 20	985	+367	42,533	+ 7,249	21½	-¾
	Swansea	,, 20	475	+ 35	24,195	+ 2,027	5½	—
	Taunton	,, 20	41	+ 1	2,332	— 196	1½	+1½
	Tynemouth	,, 10	215	— 1	14,671	+ 784	3½	—
	Weston-super-Mare..	,, 18	86	— 1	5,616	— 514	2½	+½
	Wolverhampton Dist.	,, 20	354	+ 53	18,176	+ 7,009	10½	+8
	Wrexham	,, 20	115	—	4,695	—	—	—
	Yorks. Woollen Dist. ..	,, 20	524	—	15,234	—	6	—
	Cardiff	,, 28	1,794	+287	69,460	+19,150	14	—
	Chatham & District Co.	,, 26	482	+172	25,506	+13,706	8·53	—
	Dover	,, 28	158	— 10	10,567	— 48	3½	—
	Dublin	,, 27	4,287	+ 27	113,124	+ 7,807	40½	+ ½
	East Ham	,, 28	588	+167	23,857	+ 7,052	6	+ ½
	Glasgow	,, 28	13,160	+785	856,319	+37,083	66	+ 4
	Hull	,, 28	1,830	+125	65,667	+ 3,709	11½	+1
	Ilkeston	,, 25	196	—	—	—	4	—
	Isle of Thanet	,, 28	258	+ 1	82,302	— 1,619	10½	—
	Leeds	,, 28	4,871	+351	195,064	+11,773	41	—
	Liverpool	,, 21	9,465	+572	473,875	+15,552	103	—
	Manchester	,, 28	10,969	+2956	411,384	+247,166	72	—
	Newcastle	,, 28	3,422	+488	—	—	17	—
	Portsmouth	,, 28	1,292	+ 90	64,787	+ 3,915	14½	—
	Salford	,, 30	4,021	+1265	184,569	+ 40,006	30	—
	Southampton	,, 25	848	+ 8	—	—	9	—
	Sunderland	,, 22	1,055	+ 83	42,776	+ 2,083	20	+3
	Central London Railway	,, 28	6,961	—141	139,010	— 6,860	6	—
	City and S. London Ry.	,, 28	3,030	— 461	54,691	— 8,658	6½	—
	Dublin and Lucan Elec. Rlwy.	,, 29	90	+ 3	2,856	+ 174	6½	—
	Liverpool Overhead Ry.	,, 29	1,560	+115	36,746	+ 2,428	6	—

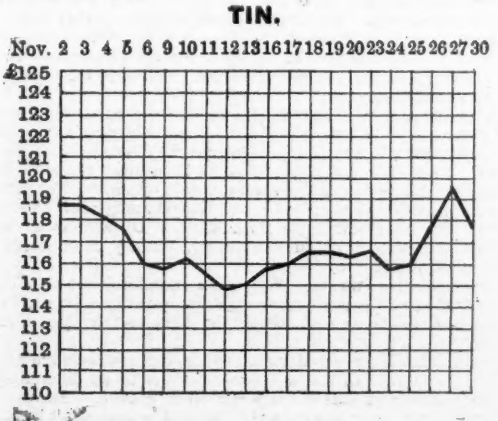
* Compared with the corresponding period of 1902.

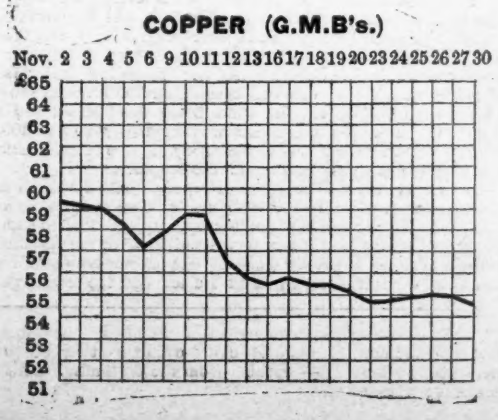
METAL MARKET.

Fluctuations in November.









INSTITUTION OF ELECTRICAL ENGINEERS.

THE EDISON ACCUMULATOR FOR AUTOMOBILES.

By W. Hibbert, Associate-Member.

(*Paper read November 26th*, 1903.)

(*Concluded from page* 885.)

Flexibility of the Cell.

The new cell will probably be called upon to stand very rapid and large fluctuations in the value of the current. The following curve, fig. 5, shows that it behaves like an elastic structure, its pressure rising and falling with varying demand, but responding at

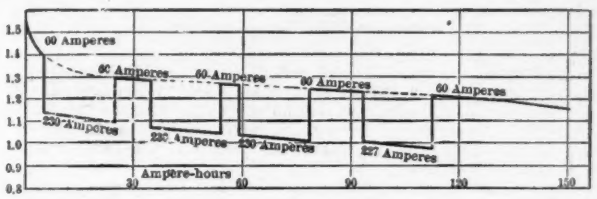


Fig. 5.

such a rapid rate that the lines of changing pressure appear vertical on the diagram. The change to and from 230 amperes will appear more trying if the weight of the cell be kept in view.

In most of the experiments so far described, the discharge was stopped when the terminal voltage fell to 0·75. At this point, as all the curves show, the pressure is falling rapidly, and would lead to the assumption that it must speedily reach zero. But this is not the case. At a still lower pressure the rate of fall suddenly alters

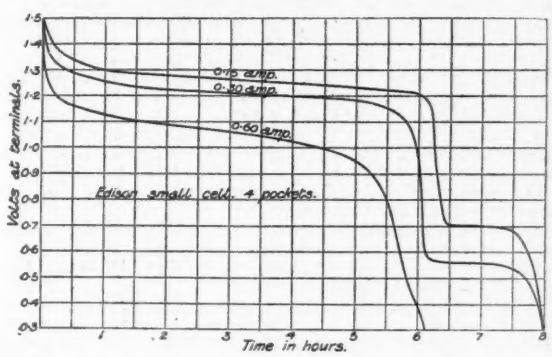


Fig. 6.

and the curve becomes flat again. Presumably this is due to a secondary chemical action arising when the active materials have been more or less changed by the ordinary discharge. The curves given above (fig. 6) indicate the extent and variation of this prolonged discharge. They were given by one of the small cells containing four pocket, two positive and two negative. The currents are small, but the indications are typical of the behaviour of larger cells.

Effect of Rest.

There are many experiments in my notebook which show that the cell does not suffer when allowed to stand discharged for fair lengths of time. A very good illustration will be given when dealing with the motor-car trials. A parallel question arises as to how far the cell can retain its charge when allowed to stand idle.

Various trials have been made, two of which may be mentioned. A cell was charged fully and allowed to stand 48 hours before discharge began. It then yielded 155 ampere-hours = 91 per cent. of the full discharge.

Part of this deficiency is undoubtedly due to the fact that a discharge commencing immediately is enriched by the gases contained in the pockets along with the active material. The experiment just alluded to was therefore regarded as giving an idea of the immediate value of this gas effect, along with the 48 hours' action due to a short rest, such as the experiment was intended to detect. To get a better estimate of the effect of rest on the active materials, the cell was now charged up again and allowed to rest for 26 days. The discharge which followed gave 124 ampere-hours.

Compared with the full discharge, 170 ampere-hours, this is equal to 73 per cent. But compared with the discharge taken after two days' rest, we have an efficiency of 80 per cent. after 24 days' rest. That is to say, the active material lost only 20 per cent. of its charge in 24 days.

The reference here made to the effect of rest on a charged cell makes this a convenient place to say how persistent is the effect of the electrolytic gases on the E.M.F. When charging is complete the E.M.F. is about 1·6 volts, and if the cell be left on open circuit

the value falls very slowly to about 1·35. It may be interesting to give a curve showing the time change in the E.M.F. when the charged cell is allowed to stand.

Efficiency.

Efficiency is not very much considered in the present methods of working traction cells. A laboratory experiment is of much less use on this point than on many others. The strength of acid employed enjoins on the user the advisability of charging up when the car comes in, and of giving the cells a "buck-up" charge if much time elapses before the car is used again. This reduces efficiency. Tested on the bench, the Edison automobile cell has an efficiency varying

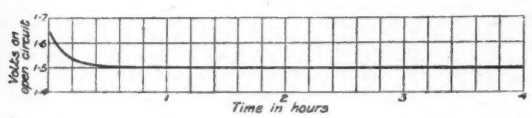


Fig. 7.

from 66 to 50 per cent. Charged and discharged at 60 amperes, I found it to be just about 60 per cent. Charged at 100 amperes and discharged at 60, the efficiency was 56 per cent. Charged for one hour at 177 ampere rate, and discharged at 60 amperes, the efficiency was 50 per cent. The highest figure (about 66 per cent.) was obtained at 30 amperes.

These figures are lower than would be found with good lead traction cells under the same condition of discharge following immediately after charge. But the experiment described on p. 921, in which a cell was kept charged for nearly four weeks, proves that under garage conditions the Edison cell would have a much higher efficiency than the cells now used.

The point is of secondary importance only, as the total cost of keeping a car in running order is so high in relation to the cost of energy, that variations in the latter are of small moment.

Observations on the Road.

In considering the conclusions which could legitimately be drawn from the foregoing laboratory experiments, it was obvious that the results might be objected to on the ground that an accumulator intended for automobiles ought to do its work on the road, subject to all the irregular vibration which travelling entails. The force of this objection is obvious, and I was anxious to get some chance of watching the battery under running conditions. Fortunately, some 40 cells arrived from America in July last, and Mr. Dick had 38 of these placed on a runabout, and gave me the chance of observing their behaviour. To this opportunity I could devote only a part of my summer holiday, and therefore the observations do not cover such a long run as is desirable. But they were long enough and varied enough to show that the laboratory results are still obtained when the work is done on the road.

A brief description of the car will suffice. It was a runabout made by the Stadebaker Co., of Indiana, weighing, when fully loaded and carrying two persons, about 1,950 lbs. Of this, 700 lbs. was due to the 38 cells and their wooden frames.

Unfortunately, the battery and motor were unhappily mated, the latter being a Westinghouse 40-volt 24-ampere machine, while the cells gave an average pressure of about 48 volts. The motor was, therefore, overloaded all the time, and if it had been a point of importance to investigate the motor and car as well as the battery, some changes would have been necessary. But as the battery could, by careful observation, be tested independently, and as time was not too plentiful, the car was accepted as it stood.

It is not necessary here to describe any of the mechanical details. The controller had four stops with four speeds, but the first and second were hardly ever used except momentarily.

It remains now to state the results of the tests. The form in which this is done is of some importance, because it ought to deal with the battery side of the investigation; traction questions proper are subsidiary. A brief statement will clear them out of the way.

Tractive Effort.—On good level road the speed was close to 14 miles per hour, and the power about 1,920 watts, which is practically equal to 2,200 watts per ton. These figures indicate about 79 lbs. per ton for the tractive effort. Allowing for the motor efficiency, and putting it at 85 per cent. (probably not so good because of overloading), the tractive effort is 67 lbs. per ton.

The work appears to be about 135 watt-hours per ton-mile, a higher figure than is usually taken in America. This is not astonishing, considering the want of balance between battery and motor.

Cost of Power.—Fourteen miles meant nearly two B. of T. units. If we take the efficiency of the cells as low as 50 per cent. (it is always low in electric traction as usually carried out), the charging would be 4 units. At 2d. per unit the cost would be 8d., or 0·57d. per mile.

Turning to the battery. The programme I drew up was intended to yield answers to the following questions:—

1. Is the capacity of the cell the same when running on the road as when discharging in the laboratory?
2. Will the battery stand excessive discharge rates on the road?
3. Will it take a rapid charge and utilise it on the road?
4. Will it recover after lying discharged for some time?
5. Does the capacity change in any detectable degree by reason of the mechanical agitation?
6. What attention is required?

When the car was handed over to me it had already been driven by the battery a distance of about 400 miles. This work was done in Paris, the charging being arranged by M. Gadot. This part of the work, however, I do not describe, the purpose being to exclude all but my own work.

The following is a diary of our runs:—

Aug. 29.	Standing discharge: 159 ampere-hours.	
„ 30.	Paris to Versailles and back, through the Park of St. Cloud. Good climb. Run about Paris	39 miles.
„ 31.	Eighteen miles towards Rouen and back. About Paris	48 „
Sept. 1. to „ 4.	Journey to London. Car ran across Paris, then train to Havre; train also from Southampton to Waterloo. Motor overhauled at Niagara Garage, and then finished the discharge by running round London. At Southampton the battery had to be partially discharged through wire	29½ „
„ 5.	London to Northampton, stopping at Dunstable for a partial charge. Part of the discharge was taken next day round about Northampton	77½ „
„ 7.	Northampton to Leicester. One stiff climb at Hopping Hill	32 „
„ 8.	Partial charge at 100 A. for 90 minutes = 150 A.H. Leicester out towards Nottingham 16 miles and back; through Loughborough ...	38 „
„ 9.	Charge 225 A H. Repeated yesterday's run with extension. Discharge 150 A.H.	77 „
„ 9.	Charged 1 hr. 55 min., 219 A H. Repeated the Loughborough run. Last six miles run out next morning.	
„ 10.	One hour's charge, 150 A.H. Same run. Discharge, 107 A.H. (32 miles).	65 „
„ 10.	Charged 1 hr. 20 min. = 242 A.H., and started off for Northampton. Storm all the way. Wind dead ahead. Most excessive discharge.	
„ 11.	Northampton to London, with partial charge at Dunstable. Run about in London ... Allowed to stand discharged for 10 days.	71 „
„ 20.	Charged for 1 hr., 186 A.H. Run round London	31 „
„ 29.	Standing discharge: 158 ampere-hours.	

The total distance run is 508 miles while under my control. Adding the 400 miles run before that time gives 908 miles.

It will be observed that several runs were made from Leicester. This was due to the fact that Mr. Hales, the engineer to Mr. Wathes, was kind enough to arrange that he would be ready to assist in charging just as I liked, and at any hour. Mr. Hales also chose for me the route followed, my request being that it should be a fairly typical English road. The conditions of each run were decided, not by the desire to make so many miles, but to solve one of the six questions already mentioned.

1. Is the capacity on the road equal to that found in the laboratory?

In order to answer this and some other questions, I determined to eliminate the influence of car and motor, and to record observations of voltmeter and ammeter while discharging, just as is done in the laboratory. It seemed to me that the trouble involved (travelling with watch and notebook in hand) was worth facing, and it certainly taught me a great deal which could not have been definitely known in any other way.

As will be seen in the section 5, a preliminary experiment proved that the battery had a capacity of 159 ampere-hours at 60 amperes.* The question was would the same quantity be available on the road? From the many observations, I choose the record of September 9th as one of those most closely watched. The run was from Leicester to some miles beyond Loughborough and back, with a final run round Bradgate Park Road. Distance = 40 miles. Eighty observations of current during the 3⅓ hours make the ampere-hours 150.

As the discharge was not then quite complete—the volts being above 0·75 per cell—it is evident that the quantity delivered in one complete discharge was practically the same as that found in the laboratory.

2. Will the battery stand excessive discharge rates on the road?

The original intention was to allow this to be determined by choosing stiff gradients for the car to negotiate. Accidentally, however, and most unpleasantly, we had a better test than that. The return journey from Leicester to Northampton was commenced in the afternoon of September 10th, the day of the great cyclonic disturbance which spread over England and the West of Europe. That 32-mile run will not easily be forgotten. My ordinary observations were impossible; recording was a failure. But I mentally noted that the current on the level rose to 55 or 60 amperes instead of 40, the wind being dead ahead and roads greasy. On the slopes the current was frequently 90 and 100, and on one hill the index passed out of my sight, and must therefore have been momentarily more than 150 amperes.

The journey took 4 hours, as compared with 2·5 hours on our outward course. The last 6 or 7 miles were covered at a slow pace, and an interesting point crops up in that connection. Although I could not make a written note of the instrumental readings, I kept a pretty constant eye on the ammeter. While these data were fresh in my mind, I calculated the discharge from

* This is somewhat lower than I found in the laboratory. Detailed examination of the 38 cells proved that two cells were of decidedly low capacity—probably from the beginning. This would account for the deficit.

the cells, and made it close to 190 ampere-hours. I regard this as a figure which errs on the side of deficiency rather than excess. If it be asked how this excessive quantity could be obtained, the answer must be found in that extra delivery at lower voltage, which is shown in fig. 6.

For many purposes this low-pressure discharge is useless, but for an emergency like that of this stormy afternoon it is a great consolation! It helps to carry the car home, although not counted in the normal capacity of the cell. It is noteworthy that the cells deliver the normal current with this lower voltage for quite an appreciable time.

3. Will the battery take a rapid charge (say one hour) and utilise it in discharge?

Several experiments of this sort have been recorded. A one-hour's charge was tried at Leicester. Unfortunately, the supply station belonging to Mr. Wathes was in a state of transition, but his chief engineer, Mr. Hales, took considerable trouble in giving us special facility; 150 amperes was the maximum current we could get at the time, owing to the unfinished state of the new building and machinery.

The cells received 150 ampere-hours in the hour, and in the subsequent run delivered 107 ampere-hours = 71 per cent. of the charge.

This is exactly the figure found in the laboratory test, and also in the standing discharge test previously described. From these three experiments it is clear that with currents of 200, 175, and 150 amperes continued for one hour each, the cell absorbs about 70 per cent. of the charge. I have not had facility for trying a still higher current, but it seems probable that the same proportion would hold good even with a higher current.

In Leicester, as in London, the run obtained from a one-hour's charge was quite satisfactory.

4. Will the battery recover after standing discharged?

The car was run about until its speed, and also the voltmeter, indicated that we were on the final slope of the discharge curves. The car was then allowed to stand 10 days in the discharged condition. At the end of that time it was charged as follows:—

For 44 minutes at about 200 amperes = 156 ampere-hours.
For 16 " " 120 " = 30 "
Total = 1 hour's charge = 186 "

The car was then run round London, and covered 31 miles, yielding 134 ampere-hours. This figure for the discharge was found by numerous observations taken during the greater part of the run, combined with less numerous readings for the rest of the time. The efficiency is $\frac{134}{186} = 72$ per cent.

From these data, it is obvious that the behaviour of the 38 cells after 10 days' idleness in a discharged condition is very similar to that observed in the laboratory when quite new, and also very similar to that observed at Leicester under high charging rate.

It was thought that the combination of harsh treatment due to standing discharged, followed by excessive charging current would prove specially trying, but the cells behaved very well even under these circumstances.

The test now recorded was followed by the final test on capacity as recorded under (5), the two tests taken together giving a decidedly affirmative answer to the question now under discussion.

As the question respecting the wisdom of leaving a discharged cell idle is one of great importance, I will make one other remark. No injury appears to arise; the cell works as well after as before. But it is advisable to charge for a longer time after such an idle time. The chemical actions—the absorption changes—are a little slower than usual; or perhaps it is more accurate to say that a greater proportion of active material is in need of restoration by the charge.

5. Does the capacity change in any detectable degree by reason of the mechanical agitations due to running?

Accumulators used for automobiles always deteriorate in capacity after a longer or shorter time. Roughly speaking, even a good battery of the lead type shows a diminished capacity after about

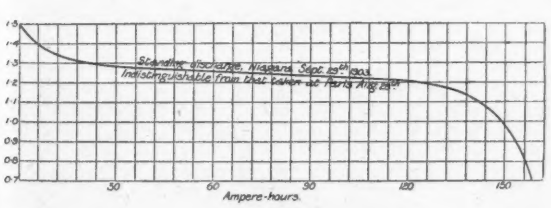


Fig. 8.

600 miles run, even by the crude test of miles per charge. Such a test must always be crude, because of the influence of the road, wind and gradient on the distance covered, even while the battery is still fresh.

As other duties prevented me taking charge of the car for more than 16 days, with no possibility of running anything like 1,000 miles, it was necessary to arrange for an accurate test of capacity at the beginning and end of the trials.

A standing discharge was therefore taken at Paris on August 29th, and gave 159 ampere-hours. This is slightly less than that found for a single cell in the Polytechnic laboratory, but on examining each cell two were found to be decidedly low, and these two brought down the pressure to the final limit rather prematurely. However, as this figure was to act merely as a standard of comparison for a similar final test, it was accepted, with all the disadvantage of two somewhat inferior cells.

On September 29th, after running 508 miles, the final standing discharge was taken, and gave 158 ampere-hours.

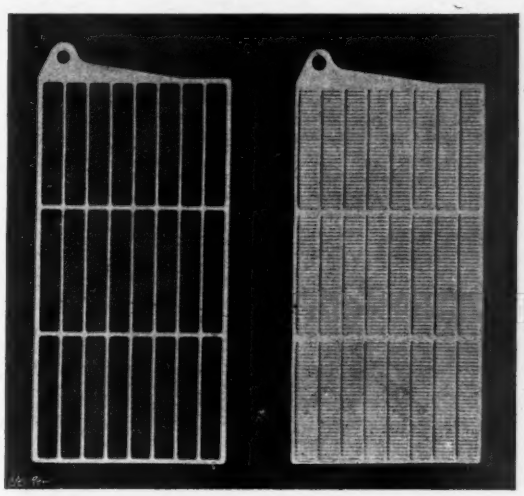
In these experiments the errors of observation may exceed 1, but do not rise to 2 per cent.

The result may be regarded as showing that the capacity remained intact during the 500-mile run.

Remembering that there were two cells in the 38 which were obviously low, probably from the beginning, it is doing no violence to accept the capacity as normal at the end of my trials, and therefore at the end of something like 900 miles run since they were put on the car. Fig. 8 gives the discharge curve. The observations at Paris and at London are indistinguishable on the scale to which this curve is drawn.

Attention Required.

To practical men this is a most important point. They have not generally done justice to accumulators, because they have been



Edison Plate, before and after the Pockets are Inserted in the Grid.

unwilling to give them that unceasing examination which is devoted to the other parts of the mechanism. If the Edison cells needed more attention than that now given to lead cells, the need would be an objectionable feature to the men who have most to do with them. It was for this reason that I was so anxious to add to my laboratory work a series of trials from the garage point of view.

For example, the laboratory could never decide one most simple question. The terminals and connections of the new cell cannot be "burned" in any way comparable with the method adopted for lead cells. Would the mere surface contact and screw-nut adopted by Mr. Edison make a lasting connection? Laboratory trials were useless for answering this question, even though it was obvious that the design of the terminal was exceedingly good from the mechanical standpoint.

However, my 500 miles on the road were sufficient to test them; not one of them failed or became weak. Not one of the terminals proper had to be touched from the beginning to the end of the run. We had rough roads and rough weather, so that the motor was seriously overloaded, and the car was so strained that it had to go into serious repair as soon as our run was finished, but the battery and its terminals endured it all. I was especially pleased to see that in the last charge but one, with a charging current of 200 amperes, the contacts were still so good that not one of them became unduly warm. Considering what they had gone through, this was a very good testimonial.

Another point about which I had some misgiving, and one that had been mentioned in the American papers, was the question of frothing. It was said that in charging, the evolved gases caused so much frothing that the liquid would soon be run out at the vent hole.

During my laboratory experiments, extending over two months' continuous work, frothing occurred on two separate occasions. But on each occasion it lasted for about one minute only. In both cases it occurred at the end of a long charge.

On the road frothing occurred with one or two cells on two occasions. Even these did not persist, and their evidence was rather in favour of the result being accidental. It is true that on the Continent I came across a cell which was said to froth rather persistently. But this probably arose from a very simple fact. A workman is very apt to treat the one kind of accumulator as he would the other. I found one of them even using oily waste to polish the cap which covers the vent hole. It is obvious, however, that many kinds of grease will be objectionable, seeing that with the alkali they readily form soap solution, with a consequent tendency to froth. Soap, grease, and all other colloids ought, of course, to be excluded, and are excluded rigorously from the cell.

As the 38 cells on the car were practically free from any degree of frothing worth mentioning, although they were put together by men who had never seen the cell before, and as this agrees with my own experience in the laboratory, I think that the objection made on this ground cannot be substantiated.

The point which requires attention, and which cannot be neglected with impunity, is the necessity for adding distilled water from time to time. As far as my own experience went, this was needed after about five or six chargings. This meant after each 160 to 170 miles run with our car. The frequency of the water addition cannot, however, have any settled relation to miles run. It depends on the number of times the cells are charged, and especially if over-charged. As different cars equipped with variable relative weight of battery run different distances on one charge, it is desirable to get this matter put into the right form at once. The men working at garage charging stations are apt to interpret everything in miles.

LIFE.

Respecting life, there is the general favourable tendency of the evidence already adduced. The cells used in the car had not changed by a detectable percentage of their original capacity at the end of my contact with them. That is the most direct testimony I can offer at present. Chemical examination is proceeding, but has not as yet reached a stage at which I can add to the present knowledge. The chemical changes may be summed up in the following equation:—

$$\left\{\begin{array}{c|c|c}\text{After charge.} & & \\ \text{NiO} & \text{KHO} & \text{Fe}\end{array}\right\} \text{ becomes } \left\{\begin{array}{c|c|c}\text{After discharge.} & & \\ \text{NiO} & \text{KHO} & \text{FeO}\end{array}\right.$$

But it is better to write the equation in a manner which, though less simple, will be more in accordance with the practical requirements Thus:—

$$\begin{array}{c|c|c}\text{After charge.} & & \\ n \,.\, NiO_2 & \begin{array}{c}KHO\\ 12H_2O\end{array} & m \,.\, Fe.\end{array}$$

$$\begin{array}{c|c|c}\text{After discharge.} & & \\ (n-p)\ NiO_2 & \begin{array}{c}KHO\\ 12H_2O\end{array} & (m-p)\ Fe \\ p \,.\, NO & & p \,.\, FeO.\end{array}$$

If I am asked my opinion as to the probability of life, the reply is definite enough. Having had these cells under close observation now for some months, I believe they will live in working order for much longer time than is usual. How much longer I cannot say, but I look forward with some confidence to such a duration as will make the Edison cell a permanent and valuable addition to the resources of electrical engineers.

Abstract of Inaugural Address delivered to the Manchester Section by Mr. E. W. COWAN, Chairman, November 17th, 1903.

MR. COWAN had intended to deal with recent developments in gas engines and producers, but found that the most interesting information was not ready for publication; he therefore took up the subject of "Some Hindrances to the Development of the Electrical Manufacturing Industry in this Country," but first referred to some local matters of interest.

A Joint Committee has been formed to consider the establishment of a common meeting place and library for the technical and scientific societies of the city, as suggested by Mr. Wordingham, and has submitted a report to the societies interested. The Chairman appealed to the members to support the movement, and pointed out some of the many advantages to be derived from such an institution, which he considered would constitute a movement of public importance to the welfare of the city.

Turning to his main subject, the Chairman stated that the electrical industry was "sick;" half the ordinary share capital invested in it was bearing no interest at all, whereas it should pay 10 per cent. "It must not be forgotten that this country must live by what it produces, and not by buying foreign goods."

It is often said that "municipal contracts are not worth having." This is due to the introduction of an element of *risk* without the corresponding chance of increased remuneration, the bargain being one-sided. The engineer's decision has to be accepted as conclusive on almost all matters in doubt; this is an element of risk which ought to be paid for. Again, the delay in payment is a heavy burden; a manufacturing firm should charge 15 to 20 per cent. interest per annum on the delayed payment—which has been known to amount to 50 per cent. of the value of the contract. A payment of thousands of pounds has been delayed for a month because of a trifling error in the tone of an electric bell! Such proceedings are illegal and tyrannous. Further, the inability of municipalities to take delivery when due has led to such delay as to absorb all the profit.

The consulting engineer will accept standard apparatus from abroad, while he alters the designs of home manufacturers without limit. "Further, the foreigner is allowed to supply apparatus in which iron is given the appearance of brass by means of gold paint; he may use fulcrum contacts for his switches, and violate many other stereotyped and cherished ideas of the English engineer. In a recent case which came under my notice a consulting engineer demanded an increase of insulation which involved serious extra expense in the design. A test was made under a pressure of about 12 times the working pressure, and the engineer invited to witness it. The only result was a refusal to discuss the question, and a repetition of the demand to add the increased insulation. Then again, the engineer will take no responsibility for his alterations, or for the satisfactory working of apparatus made to his specification. One engineer, some time ago, specified the full details of a resistance, *including the temperature rise*, with a given dissipation of watts! Another engineer having been informed that, in the opinion of the manufacturer, an alteration that he demanded would spoil the fitting, replied that if he found that was the case he would reject it. A consulting engineer does, in my opinion, too much and too little. There are, of course, notable exceptions, but I am speaking generally. He will declaim against English manufacturers neglecting to standardise, and in his own work make standardisation impossible. . . . It must have been a consulting engineer who invented the clause to the effect that the contractor was bound to satisfy himself that there were no mistakes in the drawings issued for him to work to.

"The business incapacity of resident engineers has also an indirect effect damaging to the contractor who is executing work to the specification of the consulting engineer to the municipality. The resident engineer, as he has to handle the apparatus, is naturally inclined to interfere, and he generally does so. When he complains about something, and the contractor informs him that it is in accordance with arrangements made with the consulting engineer, he replies, in the first place, by making uncomplimentary remarks about the consulting engineer, and, in the second place, asserts that he is going to have it altered. He thereby creates a curious situation, which is often amusing to everyone but the contractor. It is not generally to the interest of the consulting engineer to quarrel with the resident engineer; and though he protests that the opinion of the resident engineer has no effect upon him, it is the usual experience of the contractor that the resident engineer gets his way.

"According to my own views, the manufacturer in this country should be able to look to the consulting engineers (or resident engineers when they take the consulting engineer's place) to protect the manufacturers' interests as well as the interests of their own clients. Let them make it their business to work for the elimination of one-sided agreements in respect to contracts, and let them combine leniency with strictness in just proportion in controlling the execution of the work, and they will render a great service to the industry in this country. It is a primary condition of prosperity that the producers should be treated with justice. It must be remembered that it is seldom in the ultimate interests of a manufacturer to carry disputes to arbitration or the courts. It might be contended that it was within the power of manufacturers to protect themselves by refusing to sign one-sided contracts, &c. To do so requires that they should be in a strong position, and as I stated earlier they are now in anything but a strong position. It is foreign competition which lays its retarding hand on the enterprise of the British manufacturer of electrical manufactures, and it is foreign competition which would render united action on their part futile. I am not referring to united action to maintain prices or increased profits, but to united action in self defence from the tyranny of the buyer."

The chairman then proceeded to deal at length with the Fiscal Question. Unfortunately the limitations of our available space prohibit our reproducing in full his masterly exposition of the leading aspects of this important matter, in which, with remarkable impartiality, he weighed the pros and cons judicially. A few quotations must suffice:—"It is a matter of great regret that the principles of economic science have been not only ignored but rejected by the large majority of those who have contributed during the last few months to this discussion." . . . "Though Protection may be proved to be unscientific, it may nevertheless be desirable." . . . "Neither Free Trade nor Protection, as at present practised, has sufficient potency to drag down a country, the people of which are industrious, thrifty, skilful and enterprising, nor to save a country, the people of which lack these qualities." . . . "It is in the ultimate interests of the country that the consumer should be deprived of the advantage to him of dumping, in cases where the vested interests of manufacturers suffer." . . . "If England is surrounded by foreign countries, the people of which live according to a lower standard of life, Protection or a tariff on imports will become a necessity." . . .

In conclusion, Mr. Cowan advocated a system of Scientific Protection, as opposed to Popular Protection, whereby the advantages of competition would be retained, dumping prevented, and the Empire consolidated.

Abstract of Inaugural Address delivered before the Glasgow Section by Mr. W. A. CHAMEN, Chairman, November 10th, 1903.

The chairman first pointed out that, contrary to an existing idea, membership of the Local Section involved no cost whatever beyond the annual subscription to the Institution at headquarters; he also urged that members should not be deterred from bringing forward papers by the thought that they might not be printed in the *Journal*. Mr. Chamen then referred to the developments which had taken place in the electrical industry during recent years, beginning with the steam turbine, which had been adopted in units up to 10,000 H.P. each for driving electric generators. So successful have these larger sizes of steam turbines proved to be that this type of generating plant will in all likelihood be used before long by the Corporation of Glasgow, in connection with its general electricity supply. It would appear that, even on the point of economy in steam consumption, recent performances justify the expectation that the performance of the best known type of steam engine will be equalled if not surpassed by the turbine; but even if this should not be the case there is a large margin to the good by the saving in capital cost—the interest, sinking fund, and other standing charges on which always form a large proportion of the total cost of electricity production.

Referring to the progress of power gas plant, although in fuel economy this type of generating plant can be made to surpass either the steam engine or the steam turbine, the capital cost of the gas engine, dynamo, and producer plant, at the present time seems

to be considerably more than the cost of steam dynamos and boilers, while of course it is far greater than that of steam turbo-generators and boilers. When it is borne in mind that the cost of *fuel* per unit of electricity delivered to the consumer on an average load, like that experienced by the Glasgow Corporation electricity supply, is about ¼d., it is obvious that the other items which go to make up the total average cost of 2·94d. are of much more serious proportions; and that anything which may result in the saving of fuel (which means a reduction of this farthing) will be worse than useless if it tends to increase the standing charges.

The question of electricity distribution has advanced less than that of production. This item in the total cost of electricity supply is one of sufficient importance to warrant the expenditure of much thought, and should repay the greatest ingenuity which can be brought to bear upon it. Under present conditions, the average cost per unit delivered to the consumer is about 1·07d. in Glasgow.

Turning now to the question of demands for electricity supplies, it will no doubt be admitted by all electrical engineers that a uniform rate of charge per unit of electricity delivered to the consumer is an injustice, is unworkable, and is, in fact, impossible. It has taken some years to make this clear to the general public, but it may now be taken to be generally granted. Owing to the policy which has at last prevailed in this city, of charging as low a price as is possible for electricity supplied for driving motors, it is interesting to note that, while in May, 1902, the total horse-power of all motors connected to the electricity supply mains of the Glasgow Corporation amounted to 3,036; in May, 1903, it had increased to 4,597; while since May of this year the increase had been very large indeed. The entire removal of all smoke-yielding chimneys belonging to factories, &c., would still leave a very large amount of smoke coming from the domestic chimneys to be dealt with; but there are many cases where electricity is likely to be used for both heating and cooking. An electric radiator, for example, can be placed in a cold room, and will give out its full heat within a few seconds of being switched on. It is possible to work quite comfortably in a room with a low temperature if one of these electric radiators is near at hand, for its radiant heat at once gives the necessary feeling of warmth which cannot be obtained by other means until the temperature of the whole atmosphere of the room has been raised to a very considerable extent. This peculiarity renders the electric radiator a most handy appliance for domestic use. In offices, also, it is likely to find considerable favour.

Coupled with the ever-increasing development of the telephone, the facilities given by electric tramways for rapid transit enable those who previously found it necessary to live within a short distance of their business premises to go much further afield. That this fact is being taken advantage of to a very large extent, even within the municipal boundaries of the city of Glasgow, may be seen from the building operations which have been for some little time past actively carried on in the more outlying districts of the city.

An interesting point (though somewhat annoying to shareholders in railway companies) in connection with tramway developments is the large loss of local railway passenger traffic in and around Glasgow. The remedy for this is doubtless to be found in electrifying the local railways, in order to allow of trains being run every few minutes. The terminus system proves in present circumstances to be the block to any material increase in the number of trains above those which are at present run.

Yet another line of development is the supply of electric power over large areas of country by electricity supply companies. It may become as great a factor in the decentralising process as tramways and rapid transit railways are likely to be.

We must not altogether forget the motor-car in connection with the process of decentralisation. It is likely to play a most important part in the way of intercommunication, and also probably by acting as a feeder to railways in places where it may not pay to run tramways.

A recent demonstration of a process of welding metals by means of the oxy-hydrogen blow-pipe, in which the oxygen and the hydrogen are generated by the electro-decomposition of water, in a very simple and apparently perfect manner, is of interest, as the process is likely to come into considerable demand.

The progress made in the demand for electric light is more rapid than ever, and is so well and universally known that it scarcely requires mention.

All that tends to cheapen the cost of electricity supply, or that tends to economy in the use of it, will most assuredly result in the increase of electrical undertakings generally, and it seems that the Glasgow Section should become one of the largest in the country.

In conclusion, as there were one or two matters in the address which might be regarded as controversial, Mr. Chamen adopted the unusual course of throwing his inaugural address open for discussion.

Mr. H. A. MAVOR, Member, said that Mr. Chamen had covered a wide field, and given much food for thought in many directions. The capital cost of the station and works was a point of great importance; the total cost of a complete equipment of steam plant was about £11 to £12 per horse-power, whereas the figure for the best gas engines was about as much for the engine alone. It had long been his opinion that the wages part of the cost of central station work was higher than it ought to be. He thought that simplification of switchboard arrangements would help them in that connection. The keeping of records could be overdone, and he believed that some of the records kept were never referred to. In connection with the minimising of the smoke nuisance, there was one case where a manufacturer in the engineering trade, who was fined frequently for letting black smoke issue from his chimney, shut down his boilers and put down an 80-H.P. motor. Since he had made this change he had found that not only did he save the fines, but he had lowered his actual cost of production. He quite agreed with what Mr. Chamen had said about the effect of electric traction on the local train service. As local traffic was presently managed by the railway companies, it would be little wonder if it passed out of their hands. He asked them, in conclusion, to join with him in awarding to Mr. Chamen a hearty vote of thanks for his interesting and instructive address.

LEEDS LOCAL SECTION.

In the discussion on Mr. S. D. Schofield's paper on "Combined Refuse Destructors and Electric Lighting Stations," to which we referred in our issue of November 20th, Mr. W. EMMOT said that no one would adopt a destructor with the sole object of saving coal. In order to minimise the dust troubles, the destructor and electricity stations should be placed back to back. Better destruction was obtained in combined stations, because the steam pressure was bound to be kept within measurable limits, which was not so necessary in pumping work. As to the height of chimneys, he considered that 90 to 120 ft. was quite high enough, and that there was no need to carry the firebrick lining more than two-thirds up.

Mr. W. B. WOODHOUSE thought the sensibility of the people should be considered, and the destructor placed away from the dense portion of the town, which is, of course, not the best place for the electricity works. He considered that the author's record of 7·1 lbs. of coal per unit was absurdly high; he could generate a unit from 3½ to 4 lbs. of coke, and with a load factor like Mr. Schofield's could do much better.

Mr. PICKERSGILL said that with one Meldrum furnace he could generate all the energy necessary for nine miles of tramway. At Cleckheaton he had fitted his steam pipes with automatic valves, which were really back pressure valves, so arranged that when the steam pressure was highest in the destructor boiler it shut down the check valve in the coal-fired boiler. During clinkering the pressure of the destructor boiler falls, and the higher pressure from the other boiler closes the check valve on the destructor boiler, and allows its pressure to rise again. At Cleckheaton the refuse averages 7·0 units per ton.

Mr. A. B. MOUNTAIN asked how the load factor was arrived at. He thought the author had reckoned the running hours only. He also thought the fuel cost too low, and doubted the author's figure of 0·266d. per unit.

Mr. MELDRUM said the Shipley results would have been better had the steam been superheated, as the Parsons turbine would stand any amount of superheat. He considered, too, that had the figures for November been taken, instead of those for September, the results would have been better, as during the months July to September very little coal is burnt and the refuse contains a large proportion of vegetable matter. In some places the calorific value of the refuse falls 50 per cent. during this period. He did not agree with the author as to the value of the refuse depending upon the cost of coal in the district. Thus in a town where the cost of coal is 25s. a ton, the evaporation is 1·4 lbs. per lb. of refuse. At Grays (Essex) where coal is 21s. a ton, 42 units per ton of refuse are produced. At Sheerness the price of coal is high, and the evaporation from refuse is 1·5 lbs. per lb. At Hereford, where coal costs 18s. a ton, the evaporation is over 1·5 lbs. per lb. of refuse, whereas in Shipley, where coal is only 7s. a ton, the evaporation is about 1·7 lbs. per lb. No mention was made by the author of the use of clinker, although the speaker believed all this was used. Reckoning this at 2s. 6d. a ton, a further £250 per annum should be credited to the destructor, making a total gain of £520.

Mr. MELVIN agreed with the last speaker that a superheater would have considerably improved the figures of units per ton. As there were only three places where fuel cost was 0·26d. per unit, and Shipley was being compared with some of the best coal-fired stations, it spoke very well for the destructor that the fuel cost at Shipley was only 0·266d. per unit. He did not think the author should add 10 per cent. to the destructor costs for a stand-by boiler, as it was quite usual to keep a second boiler as a stand-by.

Mr. H. H. LEACH (communicated) gave some particulars of the Heenan & Froude destructor at Gloucester. This consisted of two grates, having a Babcock & Wilcox boiler above, with a combustion chamber intervening. The grate area was 66 sq. ft., and the rate of burning during the test was 50 lbs. per sq. ft. per hour, or 1½ tons of refuse per hour. The actual evaporation was 1·76 lbs. per lb., with a feed temperature of 55° F. A load of 140 KW. was maintained for 6 hours.

Mr. FRANK BROADBENT (communicated) agreed generally with the author's conclusions, and thought the good results obtained from destructors when run in conjunction with electricity works were due in a great part to their being under the control of an electrical engineer, which ensured getting the best results that could be got. Except in special cases, he did not think the electricity works benefited by the combination, although the sanitary authority undoubtedly did.

Mr. SCHOFIELD, in reply, said the load factor was taken on a basis of 20 hours a day, which was the time during which the cars required current. As to initial cost, if a destructor were put down solely for destroying refuse, the cost would be less than if it were combined with an electricity works. The clinker was used at Shipley for the bacteria beds, and did not concern the electricity works. The fuel cost of 0·266d. per unit was not per unit sold, but per unit generated.

Electric Lighting in Spain.—A concession has been granted to put down a plant to utilise the water power of the River Segura at El Solvente in the generation of electrical energy for lighting and power purposes at Murcia.

SPEED VARIATION OF CONTINUOUS-CURRENT MOTORS BY SHUNT CONTROL.

By H. M. HOBART.

There are continually appearing in the columns of the technical papers, and of the proceedings of engineering societies, articles relating to the question of various methods of speed control of continuous-current motors.

The method by shunt control is generally commented upon as being of very limited application, since although it is the most efficient method, it is generally held to be of limited range and to require the installation of much larger motors than would otherwise be necessary. Thus W. Cooper, in a paper entitled "Methods of Speed Control" (*Proceedings* American Inst. Electrical Engineers, April, 1903), states:—

"For instance, if a speed range of 2 to 1 is required, and the motor is run from a source of constant potential, the motor would require to be twice as large as a motor giving the same range by varying the voltage on its armature. In other words, a motor that will give 1 H.P. at 2,000 r.p.m. maximum with a weakened field, and would also be capable of running at 1,000 r.p.m. on a full field, would give 2 H.P. at 1,000 r.p.m. This motor would, of course, if designed to run at full field strength at 2,000 r.p.m., give 4 H.P."

Mr. L. R. Pomeroy, on an earlier occasion, had made the following statement:—"A motor of ordinary design will not permit of any considerable field weakening without deleterious sparking at the commutator, but with a special motor having small armature reaction, a variation in speed of 2 to 1 can readily be obtained; and when delivering a constant horse-power, the current will be approximately the same at all speeds, because the potential across the armature terminals is always the same. As the field current of a motor is only a small fraction of the total current, the efficiency of this method of control is practically the same at minimum and maximum speeds, and allows the use of a much smaller controller, and renders it possible to get a greater number of running speeds than can be economically arranged for with any other control."

To this Cooper took exception, stating:—"He says that a motor with 100 per cent. field regulation, giving a speed range of 2 to 1, costs but little more than a standard constant speed motor to do the same work. As a matter of fact, this motor is four times as large as a constant speed motor to do the same work at the maximum speed."

This assertion that, for supplying a 2 : 1 speed range by shunt control, four times as large a motor is required, continues to be repeated in the technical press, and cannot fail to have its effect in confusing this matter. In the above statements, misunderstandings that one would suppose would be generally obvious, are mixed up with genuine differences of opinion as to the relation of commutation to field strength.

Were commutation considerations not included in the comparison, it is evident that a motor would be chosen just as large and no larger than is necessary for giving the required output at the lowest speed at which continuous operation is required. This is the ideal, and entails no sacrifice so long as the efficiency is maintained. The question is as to how far the shunt motor conforms to this ideal. The shunt motor with control by rheostat in the *armature* circuit does not conform to this ideal at all, for the efficiency is sacrificed at the lower speeds. A reduction of the speed to one-half, by the introduction of resistance in the armature circuit, reduces the attainable efficiency to less than 50 per cent.; but by rheostatic control in the *field* circuit, the continuous-current shunt motor is, of all known devices, the one most adapted to satisfactory speed control throughout the widest range. In spite of the misconceptions to which allusion has just been made, this has nevertheless been understood to a more or less limited extent in some quarters. Thus W. B. Sayers, in a paper contributed recently to the Institution of Engineers and Shipbuilders in Scotland, and entitled "Speed Control of Electric Motors when Driven from Constant Pressure Mains," writes as follows:—"The shunt motor with rheostat in the shunt circuit has the valuable property of giving variable speed *without drawbacks*."

He further states: "The speed of a shunt motor, when connected to a constant pressure supply and running "light," can be increased indefinitely by reducing the magnetic field—in other words, by adding resistance to the shunt circuit. The actual limit when running "light" will, in most cases, only be reached when the armature bursts. When running under load, the point at which a limit of speed will be reached will depend upon the amount of the load as compared with the load which the motor could satisfactorily carry at normal excitation; and whether the limit is due to the heating of the armature or to destructive sparking at the commutator or other causes, will depend upon the design of the motor and its brush gear. . . . With respect to sparking, the limit would depend in the first place upon the extent to which commutation depended upon a reversing field. . . . It may be noted here that the brushes of tramway motors and of crane and lift motors which have to run in either direction, *have their brushes set midway between the pole tips*, and that being so, they depend entirely upon the action of carbon brushes for commutation."

It should be furthermore emphasised that in these latter cases, while the field strength has absolutely nothing to do *directly* with the quality of the commutation, the resulting speed as affecting the periodicity of commutation is nevertheless of prime importance.

In the discussion on Mr. Sayers's paper, Mr. H. A. Mavor threw further light on the subject in saying:—"The prime point in the matter was the commutator difficulty, and the whole thing in his opinion depended upon the reactance voltage of the windings, and that, in short, meant that there must be as many sections as there were turns in the windings, if at all practicable, and the nearer that one could come to that the better." . . . "The point which required attention was whether the commutation depended upon the magnets or the brushes. He thought that if the motor was designed specially for change of speed it was quite practicable, and better than any elaborate appliances of multiple-voltage, or of motor-generators or any such appliances, which very much complicated matters in running, and added very materially to the prime cost."

This last statement comes nearer to the facts, as he sees them, than any other which the present writer has yet come across. Nevertheless, he is of opinion that the argument may be made decidedly more simple and convincing.

In the first place, constant position of the brushes *at the geometrical neutral point* for all loads, should be assumed as the desirable basis of operation, and as now quite practicable up to high-speed ratings, permitting of more satisfactory operation the lower the speed, and (for motors of less than 100 H.P. capacity at any rate), the lower the voltage.

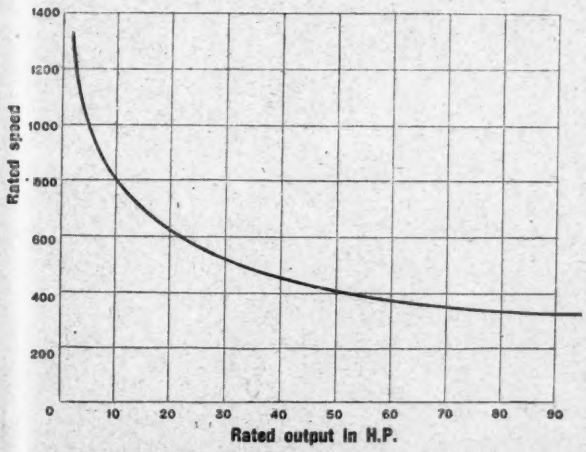
In the development of the electric motor industry, the time has arrived for standardising this practice of operating motors at all loads with the brushes at the *geometrical neutral point*. This is a much more satisfactory basis even for constant speed motors; it becomes still more important for variable speed motors and is *unavoidable* for reversible motors. It is, in the following, assumed that for "fixed brush position for all loads" which has long been standard practice, there is substituted the more modern requirement of "fixed brush position at the geometrical neutral point for all loads." Just as in the earlier days it was claimed that the former requirement necessitated a more expensive design, so is this to-day often maintained as regards the more exacting requirement that the "fixed brush position" shall be the "geometrical neutral point." It may be admitted that this would be true for some combinations of the three factors—rated output, voltage, and speed. But it is good engineering to avoid unfavourable combinations whenever practicable, and if this is done, there still remains an enormous range of work for which the continuous current shunt motor can be used with better advantage than any other type. In so far as high speeds are insisted upon, either must the manufacturer be prepared to incur greater expense in construction as regards commutator sub-division, large armature diameter and otherwise, or the customer must be prepared to be contented with a less satisfactory motor as regards commutation.

It may in general be said that 90 per cent. of all manufacturers of continuous-current motors are expending too

little on their high speed motors, and are wastefully constructing their low speed motors. A motor of small diameter and considerable axial length, is, for its output, in general the cheapest to manufacture. But for a high speed motor the design must be of relatively large diameter and short, hence expensive, otherwise the commutation will be defective. On the other hand, a low speed motor *may* be of small diameter and long, hence cheap for its output, and may still have excellent commutation; but there is a tradition to the effect that the utilisation of the material is higher the higher the peripheral speed, and so usually one finds low speed motors also designed of large diameter and short in length. From a recent article describing a new line of slow speed motors, the following is quoted:—"In order to employ the material to the best advantage, it is necessary, at such slow speeds, to have a reasonably high peripheral speed of the armature; this can only be done by making the armature of considerable diameter and very small width." It will probably be generally conceded, at any rate by manufacturers, that unless commutation requirements are such as to necessitate a short machine of large diameter, such a design is undesirable and expensive; as, except in the very smallest diameters, the liberal use of ventilating ducts will suffice to prevent heating from being the limit of output. The limit of output will, for high speed designs, be commutation, and, except in totally enclosed motors, regulation or efficiency, or both, for low speed designs.

Now the commutation of a given machine, and for a given quality of brush, design of brush-holder, &c., depends upon its reactance voltage, and the latter depends upon two factors—the current and the speed. Hence a variable-speed machine must be designed for good commutation at the highest speed and the highest current, or, better, for the highest value of the product of speed and current which it will be required to carry.

Up to moderate values for the required maximum speed, this design may also be the cheapest design, and no rating down will, on account of commutation, be necessary for a variable-speed or reversible motor, so far as relates to its performance at its highest speed, although, of course, its ultimate capacity must be based on the output which it is required to carry continuously at its lowest speed, and it is with constant-speed motors for this lowest speed, that its cost must be compared.



For a given rated output, a maximum speed not exceeding that given in this curve will, for 250-volt motors, permit of sparkless operation with brushes in the geometrical neutral position, with a design which, as regards diameter and length of armature, is irrespective of commutation considerations, proportioned for minimum cost.

The curve for 500-volt motors would lie below, and that for 125-volt motors, above, that for 250-volt motors.

The curve sets forth the maximum speed.

If a 3:1 speed range is desired, the motor will be proportioned for its rated output at one-third of the speed shown by the curve, and the speed of the curve will, with this same rated output, be obtained by field control and with the brushes at the geometrical neutral point.

Fig. 1.—Maximum Speeds of 250-volt Motors.

In the accompanying curve are plotted very conservative values for the speeds for various outputs for 250-volt motors up to which a motor commutating excellently at all loads and speeds, with the brushes fixed at the geometrical neutral point, when compared on the basis of its lowest speed, taking this lowest speed at which continuous operation at the rated output is required, as being not less than 20 per cent. of the maximum speed, will be as cheap as could be the case for a constant speed motor of the same output.* For 500-volt† motors the curve would, for the smaller ratings, lie a little lower, and for 125-volt motors, higher. Up to 50 per cent. above these speeds, the case is by no means serious, but it might entail a rating down of some 10 per cent. to 20 per cent. in the interests of good commutation under the specified conditions.

The altogether different presentation of the case in these other papers, is due to two main reasons:—

First, the writers are accustomed to, and have in mind, the phenomena in motors designed for operation with a backward brush lead, the commutation being dependent upon the magnetic "fringe" from the field and hence very dependent upon field strength, not only as affecting the periodicity of commutation due to increased speed with weakened field, but also on account of the weakened commutating "fringe," which accompanies the weakened field at higher speeds.

Second, the writers are referring to motors primarily designed for speeds which Mr. Sayers in the paper referred to, describes as:—"The speeds which years of costly experience have gradually settled into standards." These he gives as being approximately as under:—

Horse-power.	Speed in revolutions per minute.
3	1,000 to 1,250
5	950 to 1,100
10	850 to 1,000
15	700 to 900
20	650 to 750
50	500 to 650
100	400 to 500

Now, these speeds are considerably above the maximum speeds shown by the writer in fig. 1, and have, in the writer's opinion, been arrived at, not from any demand for those particular speeds, but from a belief on the part of manufacturers that the higher the rated speed, the lighter and cheaper the motor. This is only the case—with the *continuous*-current motor—to a very limited extent, in virtue of the fact already explained, that the slower the speed of the motor, the more favourable to low cost, may in general, be the value of the ratio of length to diameter—*i.e.*, the higher may be its "specific output" for a given quality of commutation—and when lower speeds have been employed, it has generally been on the lines criticised above, of employing a "reasonably high peripheral speed," and thus voluntarily sacrificing the saving in material and labour which becomes not only possible but desirable with lower rated speeds. Even Mr. Sayers's speeds, while much too high to be consistent with the cheapest designs for variable speed work, are lower than those of many manufacturers' standard lists.

A comparatively moderate step downward from present practice, as relates to the speed of continuous-current motors, at once renders possible by suitable design, the production of wide-range variable speed shunt motors without extra cost or special design. The spool windings should be designed to give their full strength with normal heating at the minimum desired speed, and furthermore, of course, the design in general must correspond as regards heating to the lowest speed at which permanent running at the rated output is required, and as regards commutation, to the highest speed ever required from the motor at this output. The extension of the use of the shunt motor for variable speed work, would be distinctly promoted by attention to the principles set forth in this article, namely, first, a moderate decrease in the customary speeds; secondly, the employment of designs of as high a ratio of length to diameter as is consistent with obtaining sparkless commutation with the brushes at the geometrical neutral point, the highest permissible value of this ratio being inversely proportional to the rated speed.

The further caution may not be superfluous, that in following these lines, liberal provision must be made for

* Motors for higher maximum speeds than those shown in the curve for a given output, can, of course, also be designed for sparkless operation with the brushes at the geometrical neutral point, but the ratio of armature diameter to length must be greater than that corresponding to the cheapest design otherwise practicable, and in proportion to the extent by which the desired maximum speeds exceed the speeds set forth in the curve.

† It is thus interesting to see that 500-volt motors *should*, from technical considerations, be rated at lower speeds than motors for lower voltage. In their efforts toward minimum cost, however, manufacturers rate them at higher speeds, thus intensifying their inherently poorer commutating properties.

ventilating ducts in the armature core. The results, moreover, can only be obtained when the highest practicable commutator sub-division is adopted.

OUR LEGAL QUERY COLUMN.

[Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.]

"M.I.E.E." writes:—"Will you kindly inform me, through the columns of the REVIEW, if a Corporation supply has the right to charge two rates, viz., 4d. to an ordinary consumer and 2d. to a larger one, in both cases for lighting current?"

*** Assuming that the corporation of the town to which "M.I.E.E." refers act under the powers which are usually conferred by a provisional order, it would seem clear that they have no authority to charge different prices to different consumers of the same class. It is provided by Sec. 19 of the Electric Lighting Act, 1882, that where a supply of electricity is provided in any part of an area for private purposes, then, except in so far as is otherwise provided by the terms of the license, order, or special Act authorising such supply, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled *under similar circumstances* to a corresponding supply. Sec. 20 of the same Act provides that the undertakers shall not, in making any agreements for a supply of electricity, show any undue preference to any local authority, company, or person, but, save as aforesaid, they may make such charges for the supply of electricity as may be agreed upon, not exceeding the limits of price imposed by, or in pursuance of, the license, order, or special Act authorising them to supply electricity. These provisions would seem to make it plain that a charge of 2d. to one consumer and 4d. to another of the same class is not justifiable. There is nothing, however, to prevent the undertakers from dividing the consumers into classes, and charging such classes at different rates. This is, in fact, the universal practice.

The form of provisional order which appears in the schedule to the Electric Lighting (Clauses) Act, 1899, emphasises the fact that there must be a uniform charge throughout the district, for it provides that a consumer, if required by the undertakers, must enter into a written contract with them to continue to receive and pay for a supply of energy for a period of at least two years, of such an amount that the payment to be made for the supply at the rate of charge for the time being charged by the undertakers for a supply of energy to ordinary consumers within the area of supply, shall not be less than £20 per cent. per annum on the outlay incurred by the undertakers in providing any electric lines required under this section to be provided by them for the purpose of the supply; and, if required by the undertakers, give to them security for the payment to them of all moneys which may become due to them by the owner or occupier in respect of any electric lines to be furnished by the undertakers, and in respect of energy to be supplied by them.

NEW PATENTS APPLIED FOR, 1903.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

24,847. "Improvements in or relating to electro-mechanical automatic switches for surface contacts for electric tramways and railways, also applicable for automatic signalling on railways and tramways, and for other similar purposes." M. G. WAGGOTT. November 16th.

24,848. "Improvements in the electro-deposition of zinc." S. COWPER-COLES & Co., LTD., and S. COWPER-COLES. November 16th.

24,864. "Improvements in or relating to electrical clocks." F. A. CHANDLER and B. BONNIKSEN. November 16th.

24,905. "Improvements in connection with electrolytic cells." A. G. HADDOCK. November 16th.

24,909. "Improvements in electric lamps and methods of making the same." C. P. STEINMETZ. (Date applied for under Patents Act, 1901, November 17th, 1902, being date of application in United States.) November 16th. (Complete.)

24,912. "Improvements in and relating to apparatus for utilising electrical energy in igniting, heating and lighting, or such like uses." J. I. AYER. November 16th. (Complete.)

25,016. "Improvements in electrical storage batteries." T. E. CORNWELL. November 17th.

25,020. "Improvements in or relating to means for automatically governing electric motors, especially applicable for breaking or reducing the current in electric motor vehicles when a given speed of such vehicle is exceeded." F. M. STAUNTON. November 17th.

25,022. "Improvement in couplings for electrical conduits." A. MCMURTRIE. (Date applied for under Patents Act, 1901, November 21st, 1902, being date of application in United States.) November 17th.

25,028. "Improved adjustable electric light pendants or fittings." M. H. GALSWORTHY and THE LONDON ELECTRICAL FITTINGS Co., LTD. November 17th. Complete.)

25,053. "Improvements in electric lighting and power systems." G. G. MILNE. November 17th. (Complete.)

25,074. "Improvements in electrical demand or rebate indicators." G. W. L. CASE and the REASON MANUFACTURING Co., LTD. November 17th.

25,087. "Improved method and devices for preventing interference in wireless telegraphy and the like." J. GARDNER. November 18th.

25,110. "Electric tramcar trolley pole attachments." J. H. AIREY. November 18th.

25,114. "Improvements in or relating to coin-freed electric meters." J. ALLAN. November 18th.

25,122. "Improvements in electric arc lamps." J. B. FOURNIER. November 18th. (Complete.)

25,127. "Improvements in telephone exchange systems." W. AITKEN. November 18th.

25,132. "Improvements in or relating to electrolytic cells." E. A. ASHCROFT. November 18th.

25,133. "Improvements in or relating to plates for electric storage batteries." E. A. ASHCROFT. November 18th.

25,146. "Improvements in controllers for electric motors." G. LAIRD and J. P. TODD. November 18th.

25,150. "Improved magnetic ignition device for explosion engines." G. HONOLD. November 18th. (Complete.)

25,153. "Improvements in or relating to arc lamps." L. CIBIE. November 18th.

25,163. "Improvements in the electrolytic refining of copper." THE METALS CORPORATION LTD., and S. COWPER-COLES. November 18th.

25,189. "Improvements in electric switching devices." M. H. BARBER and G. H. LARMUTH. November 19th.

25,197. "Improvements in dynamo-electric machines and motors." W. R. V. MARSHALL. November 19th.

25,199. "Improvements in switches for use in connection with the electrical ignition systems of motor cycles and for analogous purposes." C. T. B. SANGSTER. November 19th.

25,222. "Protective device for electric circuits." H. H. HORNSBY and E. W. ANGER, Jun. November 19th.

25,244. "A novel electric lamp." W. P. THOMPSON. (E. L. Frenot, France). November 19th.

25,245. "New or improved electric lighting system." W. P. THOMPSON. (E. L. Frenot, France). November 19th.

25,280. "Improvements in electric sparking devices for internal combustion motors." L. H. STRAIN. November 19th.

25,284. "A new or improved support for electric cables." E. T. RUTHVEN-MURRAY. November 19th.

25,322. "Improvements in or connected with electrical resistances." P. MACAULAY, A. MATTHEWS, and H. P. HOGHTON. November 20th.

25,341. "Improvements in contact breaking devices for the electric ignition apparatus of gas, petrol and the like engines." L. W. HUBER and G. B. MERCER. November 20th.

25,343. "A new self-testing electric sparking plug for motors, viz., 'desideration plug.'" E. M. GOLDBURGH. November 20th.

25,349. "New or improved radiator or reflector to incandescent electric or other lights or lamps when arranged as letters and signs for advertising purposes, or when used for lighting." J. A. STEVENS. November 20th.

25,381. "Improvements in circuit-breakers and closers especially suitable for the transmitting instrument used in wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH Co., LTD., and A. GRAY. November 20th.

25,383. "Improvements in the transmitting instruments for wireless telegraphy." J. A. FLEMING and MARCONI'S WIRELESS TELEGRAPH Co., LTD. November 20th.

25,386. "Improvements in electro-magnetic tremblers." B. BECKER. November 20th.

25,389. "Improvements in magneto-electric induction apparatus." A. G. BLOXAM. (A. Schoeller, Germany.) November 20th. (Complete.)

25,461. "Improvements in apparatus used in wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH Co., LTD., C. S. FRANKLIN, H. A. MADGE, and E. BERRY. November 21st.

25,462. "Improvements in transmitting instruments for wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH Co., LTD., and R. G. KINDERSLEY. November 21st.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1903.

DYNAMO-ELECTRIC MACHINES. C. Macku. 18,458. August 27th.

SECONDARY OR STORAGE BATTERIES. H. Wade. (H. Bodman, United States.) 18,495. August 27th.

PORCELAIN AND OTHER ELECTRIC INSULATORS. W. E. Langdon, J. C. Fuller and G. Fuller. 18,586. August 28th.

CHECK OR INDICATOR APPLICABLE TO THE ELECTRIC CONTROLLER OF ELECTRICALLY-DRIVEN VEHICLES. A. R. L. Wille. 18,953. September 2nd.

The Engineering Standards Committee.—The above Committee has now issued a report on the influence of gauge, length and section of test bar on the percentage of elongation. The report is by Prof. W. C. Unwin, and it is based on tests of steel-plate test-bars supplied from the Dalzell Steel Works, N.B., and the Parkgate Steel Works. It contains copious appendices and diagrams, illustrating the various results obtained, and as it is believed that no such complete data as to the variation of elongation under different conditions have been previously available, engineers and others interested in this matter will be well advised to give the report careful perusal.

Commutation under Oil.—The suggestion has been made by M. Osnos that a hollow commutator containing oil should be used for direct current machines, the brushes bearing on the interior of the cylinder, and being, therefore, immersed in oil. By this means satisfactory collection could be obtained without short-circuiting the armature sections, a double winding being used with interlaced commutator segments. The oil would suppress sparking, even with high voltages between the segments, and metallic brushes could be used, requiring less contact surface. M. Osnos believes that single-phase motors with commutators could also be constructed on these lines with advantage.